FIVE-YEAR REVIEW REPORT FOR ACE SERVICES SUPERFUND SITE THOMAS COUNTY, KANSAS

Prepared by

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Region 7
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Date

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LIST OF ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
BVSPC	Black & Veatch Special Projects Corp.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Cr	Chromium
EPA	Environmental Protection Agency
GAC	Granular Activated Carbon
Gpm	gallons per minute
GWTP	groundwater treatment plant
GWTS	groundwater treatment system
HI	Hazard Index
KDHE	Kansas Department of Health and Environment
LTRA	Long Term Response Action
MCL	Maximum Contaminant Level
Mg/kg	milligrams per kilogram
Mg/L	milligrams per liter
Msl	mean sea level
NAWQC	National Ambient Water Quality Criteria
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PLC	programmable logic controller
POTW	Publicly Owned Treatment Works
PRG	Preliminary Remediation Goal
PWS	public water supply
RA	remedial action

RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RSE	Remedial System Evaluation
RTU	Remote Terminal Unit
SARA	Superfund Amendments and Reauthorization Act
TCLP	Toxicity Characteristics Leaching Procedure
Ug/L	micrograms per liter
VOC	volatile organic compound

EXECUTIVE SUMMARY

This second Five-Year Review Report has been completed for the Ace Services Superfund site in Colby, Kansas. The site is located at 500 East Fourth Street in Thomas County. The surrounding area is primarily commercial and industrial with a few residences nearby. Total chromium and chromium VI (hexavalent chromium) were found in groundwater beneath the site which originated in the area of the former Ace Services business.

Northwest Manufacturing Company operated a plating facility at the site from 1954 to 1969. Ace Services was formed in 1969 and operated a chromium electroplating operation at the site through 1989. The Kansas Department of Health and Environment (KDHE) began an investigation of improper plating waste management practices by Ace Services in 1971. In 1975 a wastewater treatment facility was built on the east side of the plating building and plating waste was treated in this wastewater treatment facility and discharged to an unlined evaporation lagoon to the east of the facility.

In 1980 elevated chromium levels were detected in the Colby, Kansas public water supply well PWS-8 east of the Ace Services facility and in a few residential wells. The PWS-8 well was taken out of service by the city. During a follow-up investigation KDHE found improper waste handling practices and lead and chromium contamination in lagoon area soil. Ace Services contracted with a consulting engineering firm for the excavation of 500 to 1,000 cubic yards of contaminated soil in the lagoon area.

The site was added to the National Priorities List (NPL) in 1995. A Record of Decision (ROD) was written in 1999 and an amended ROD was written in 2001. The remedy requires remediation of the groundwater to the Maximum Contaminant Level (MCL) for total chromium 100 ug/L. The site was divided into operable unit 1 (OU1), and operable unit 2 (OU2); however, this is not discussed in the ROD or the amended ROD. The first operable unit, OU1 included cleanup of the floor surfaces in the plating and machine shop buildings and debris removal. The second operable unit OU2 included a first phase, demolition of the buildings and removal of contaminated soil, and a second phase, construction of the ion-exchange groundwater treatment plant and extraction wells.

The ion-exchange groundwater treatment plant and extraction wells were constructed and began operating August 12, 2003. The groundwater treatment plant and extraction wells are operated by the city of Colby under a Cooperative Agreement with the U.S. Environmental Protection Agency (EPA). Black & Veatch Special Projects Corp. (BVSPC) designed the groundwater treatment plant. BVSPC provides semi-annual sampling of groundwater on-site and the completion of reports showing the data and the progression and changes in groundwater plumes. Semi-annual audits of the operation of the ion exchange groundwater treatment plant and extraction wells are provided by BVSPC and audit reports are prepared semi-annually. BVSPC provides technical oversight and support of the operation of the groundwater treatment plant by the city of Colby.

An optimization study was completed by the EPA with a remedial system evaluation report in 2007. The first five- year review report was completed by the agency on September 19, 2008. A recommendation of the 2007 optimization was a source evaluation. A source evaluation report was prepared by BVSPC in 2009. After review of the source evaluation report further remedial measures were considered. In 2010 an additional extraction well, EX-6-S, was installed in the area of the highest chromium

concentrations in soil and groundwater. A geomembrane cover was constructed in 2011 over the area of highest chromium concentrations in soil, the former lagoon area, to inhibit the migration of chromium into the groundwater. An Explanation of Significant Differences (ESD) by the agency in April 2012 documented the installation of the extraction well and geomembrane cover.

A second optimization study was initiated by the EPA in 2012. The optimization recommendation memorandum recommended the installation of packers in two extraction wells, PWS-8 and EX-5 I/D, and the increase of extraction well pumping rates with a pumping goal of 20 ppb to account for rebound. The installation of the packers in the extraction wells allowed the extraction of groundwater from the intermediate zone of the aquifer and isolation of the deep zone which is clean. The recommendation from the EPA HQ contractor was to increase pumping of extraction wells upgradient near the groundwater treatment plant and decrease pumping rates from the downgradient to the upgradient direction until chromium concentrations are below the action level. These optimization recommendations have been implemented.

The remedial action has been implemented at the Ace Services site. Exposure pathways to groundwater have been removed through connection of private wells to the city water system and an institutional control in the form of a permit requirement by the city for installation of new wells. The site property is zoned light industrial. The groundwater plume containing chromium has been reduced during the Long Term Remedial Action (LTRA), the first ten years of operation of the ion exchange groundwater treatment plant and extraction wells. Following the LTRA, the Operation and Maintenance (O&M) phase will be conducted by the KDHE. The Ace Services OU1 is protective in the short term and the need for additional institutional controls on the property will be evaluated; OU2 is protective of human health and the environment. The Ace Services site is protective of human health and the environment in the short term.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Ace Services		
EPA ID: KSD046746731		
Region: 7	**State:** KS	**City/County:** Colby/Thomas

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: **If "Other Federal Agency" was selected above, enter Agency name:**
Author name (Federal or State Project Manager): Catherine Barrett, Federal Project Manager
Author affiliation: EPA
Review period: 09/19/2012 – 09/19/2013
Date of site inspection: 10/30/2012
Type of review: Statutory
Review number: 2
Triggering action date: 09/19/2008
Due date ***(five years after triggering action date)*****:** 09/19/2013

Five-Year Review Summary Form (continued)

ISSUES/RECOMMENDATIONS				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
OU2				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU1	**Issue Category:** Institutional control			
	Issue: deed restriction			
	Recommendation: evaluate additional institutional controls			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/KDHE	EPA/KDHE	09/30/2018

PROTECTIVENESS STATEMENT(s)
Operable Unit: *OU1* — *Protectiveness Determination:* *Protective in the short term*
Protectiveness Statement: Ace Services OU1 is currently protective of human health and the environment in the short term.
Operable Unit: OU2 — *Protectiveness Determination:* Protective
Protectiveness Statement: *Ace Services OU2 is protective of human health and the environment.*

SITEWIDE PROTECTIVENESS STATEMENT(if applicable)
Protectiveness Determination: Protective in the short term
Protectiveness Statement: Because the remedial actions at OUs are currently protective of human health and the environment, Ace Services site wide is currently protective of human health and the environment in the short term.

1.0 Introduction

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings and conclusions of reviews are documented in five-year review reports. In addition five- year review reports identify issues found during the review, if any, and recommendations to address them.

The U.S. Environmental Protection Agency is preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121 (c) and the National Contingency Plan (NCP). CERCLA Section 121(c) states:

> If the President selects a remedial action that results in any hazardous substances, pollutants or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with Section 104 or 106, the President shall take or require such action. The President shall report to the 'Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The EPA interpreted this requirement further in the NCP; 40 CFR 300.430 (f) (4) (ii) states:

> If a remedial action is selected that results in hazardous substances, pollutants or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

The EPA has conducted a five-year review of the remedial actions implemented at the Ace Services site in Thomas County. This review was conducted from September 19, 2012 to September 2013. This report documents the results of the review.

This is the second five-year review for the Ace Services site and the triggering action for this review is the completion date of the first five-year review. The five-year review is required due to the fact that, upon completion, chromium remains on site above levels that allow for unlimited use and unrestricted exposure.

The site is comprised of two operable units. OU1 included the scarification of the floor surfaces in the plating and machine shop buildings and debris removal from inside and outside the buildings. OU2 included removal of metal and plating shop buildings and foundations, excavation of soil beneath these structures to a depth of 15 feet below grade, and construction of an ion-exchange groundwater treatment plant and building and extraction wells.

2.0 Site Chronology

A site chronology of significant site events and dates is shown in Table 1.

Table 1 Chronology of Site Events

Event	Completion Date
Discovery	08/01/1980
Preliminary Assessment	10/01/1982
Site Inspection	11/06/1982
Preliminary Assessment	09/28/1989
Site Inspection	09/28/1989
Aerial Survey	04/18/1990
Expanded Site Inspection	11/27/1991
Non-National Priorities List Potentially Responsible Party Search	09/08/1992
Removal Assessment	10/15/1993
Hazard Ranking System Package	05/06/1994
Information Repository Established	07/08/1994
Removal Action – Soil Building Surface Decontamination	07/14/1994
Listing on National Priorities List	09/29/1995
Remedial Investigation/Feasibility Study	05/05/1999
Record of Decision	05/05/1999
Remedial Design	08/1999
Remedial Action – Building Decontamination	02/04/2000
Record of Decision Amendment	09/13/2001
Remedial Design – Groundwater Pump and Treat	01/09/2002
Remedial Action – Building Demolition	04/30/2002
Remedial Action – Groundwater Treatment Plant Began Operation	08/12/2003
Interim Remedial Action Report	09/19/2003
Preliminary Close-Out Report	09/22/2003
First Optimization, RSE Report	09/2007
First Five- Year Review	09/19/2008
Explanation of Significant Differences (ESD)	04/09/2012
Second Optimization , Optimization Review Memorandum	11/01/2012
LTRA Audit Report Numbers 17-25	01/13/2013
LTRA Cleanup Status Report Numbers 10-14	02/08/2013
Long Term Response Action	04/16/2014

3.0 Background

3.1 Physical Characteristics

The Ace Services site is located at 500 East Fourth Street near the edge of Colby, Kansas in Thomas County. The site lies in the southwest quarter of section 31, Township 7 South, Range 33 West. The site is next to a small church in a commercial and industrial area with a few residences nearby.

Prior to the start of the remedy, a chromium groundwater plume originated in the general area of the former Ace Services business and extended approximately one and one-half miles east-southeast. The width of the plume varied from 500 to 1,000 feet. The northern plume boundary was approximated by U.S. Highway 24, and the leading edge was just east of the city boundary along Highway 24. These site boundaries were based on the maximum extent of the 100 micrograms per liter (ug/L) total chromium isoconcentration line.

The ion exchange groundwater treatment plant and extraction wells were constructed and began operation August 12, 2003. The first five-year review, completed in September, 2008, estimated that 90 percent of the plume had been cleaned up when comparing the reduced size of the total chromium isoconcentration lines making up the plume in September 2008. The remedial action taken has significantly reduced the extent of the chromium plume to a few isolated areas that continue to exceed the action level of 100ug/L total chromium.

3.2 Land and Resource Use

The Ogallala Aquifer lies beneath the site and this aquifer is a source of primary potable water for the region and the city of Colby and for individual residences in the site area that are not connected to the municipal water system of Colby, Kansas. A Colby, Kansas municipal water supply well, PWS-8, was found to be contaminated with chromium and was taken out of service because of the contamination.

The site was used as a storage facility at the time of the ROD, and was surrounded by commercial or industrial and residential areas. Future use of the site is expected to be industrial or commercial. The site property is currently zoned light industrial by the city of Colby.

An institutional control is in place in the form of a permit requirement for installation of new wells within the city of Colby. A city ordinance controls groundwater use by controlling the location of the installation of new groundwater wells.

3.3 Site History of Contamination and Enforcement Activities

During the years 1954 to1969 Northwest Manufacturing Company operated a plating operation at the site. Ace Services was formed in 1969 and operated a chrome electroplating operation through 1989. The site included two buildings, the plating building and an office/machine shop building. The plating building included three concrete cinder block troughs where vats of plating solution were located during operations. In 1971 the KDHE began an investigation into improper plating waste management practices by Ace Services. In 1975 a wastewater treatment facility was built on the east side of the plating building. Plating waste was treated in the wastewater treatment facility and discharged to an unlined evaporation lagoon to the east of the plating facility.

In 1980 elevated chromium levels were detected in Colby, Kansas Public Water Supply well PWS-8 located about one-fourth mile east of the site, and in other nearby private wells. PWS-8 was removed from service. During a follow-up investigation KDHE observed improper waste handling practices, and lead and chromium contamination was found in lagoon soil. In 1981 Ace Services paid an engineering firm for the excavation of 500 to 1,000 cubic yards of contaminated soil from the lagoon area.

In 1988 KDHE issued an Administrative Order requiring Ace Services to clean up the site. Ace Services did not comply with that order. Ace Services terminated operations at the site in 1989 after losing corporate status due to failure to pay taxes and fees.

In 1992 KDHE coordinated the removal of plating wastes from the plating shop building. Investigations undertaken as part of this removal determined that the floors and walls of the troughs were contaminated with lead and chromium. It was further determined that the contamination may have migrated into the underlying soils. This assessment also found that elevated levels of lead and chromium were still present in the lagoon soils east of the wastewater treatment facility.

In 1994 the EPA conducted a removal action to clean up additional contaminated soils, concrete and structures at the site. This action established clean up goals for soils of 1500 mg/kg total chromium and 500 mg/kg total lead. The wastewater treatment facility was demolished and removed in this action. The walls and floors of the three plating troughs were removed and the underlying soils were excavated. Not

all of the contaminated soils could be removed at that time due to concerns for undermining the building structure. Once the contaminated soils that could be accessed were removed, the trough excavations were backfilled with clean soil and topped with concrete level with the remaining floor slab in the building.

As part of the 1994 removal, an attempt was made to reduce the chromium VI in the surface layer of the concrete floor slab to less toxic chromium III by applying a sulfuric acid solution followed by sodium meta-bi-sulfite. The 1994 cleanup also included an assessment of the lagoon area which determined that there were soils contaminated in excess of the cleanup goals. Approximately 500 tons of soil were excavated from the lagoon and disposed of.

The Ace Services site was added to the National Priorities List (NPL) in September 1995. Sampling conducted in 1996 and 1999 indicated that areas of the plating shop floor slab surface were still contaminated. These areas were scarified (ground down) removing approximately 1 inch from the top of the concrete surface.

The Ogallala Aquifer underlies the area in and around Colby, Kansas. A portion of this aquifer has been contaminated with hexavalent chromium from releases at the site. Groundwater sampling was performed from 1980 through 2000 with much of the sampling being done between 1996 and 2000. The sampling efforts indicated that the chromium plume was approximately a mile long, one-fourth mile wide and 130 feet thick with the western edge of the plume beginning in the proximity of the site. Concentrations of Cr VI up to 4,000ug/L were found in the groundwater. The ROD required remediation of the groundwater chromium plume to the maximum contaminant level (40 CFR 141 62) of 100ug/L total chromium. The prescribed method of remediation was a pump and treat system utilizing ion exchange to remove chromium from the extracted groundwater with discharge limits of 17ug/L hexavalent chromium and 100ug/L total chromium and a groundwater cleanup level of 100ug/L.

3.4 Basis for Response Action

The baseline risk assessment estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. Actual or threatened releases of hexavalent chromium from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

The evaluation of noncarcinogenic risks for current downgradient residents and future on-site and off-site residents through the groundwater exposure pathway resulted in hazard indices of 0.42 and 20.0, respectively. A hazard index calculated for a site in excess of 1.0 indicates that potential adverse health effects may occur from exposure to the site contaminants. For the site, the hazard index exceeded 1.0 for future residents drinking and bathing in groundwater contaminated with hexavalent chromium.

4.0 Remedial Actions

4.1 Remedy Objectives

The primary focus of the remedial actions was to remediate the contaminated groundwater and remove the on-site building, the major risks posed from the site, and to limit future use of the facility to industrial or commercial purposes.

Remedial action objectives developed for contaminated groundwater are to prevent ingestion, inhalation or direct contact with groundwater having chromium concentrations in excess of current regulatory drinking water standards and to prevent further migration of chromium to prevent further degradation of natural resources.

Remedial action objectives developed for contaminated soil are to maintain prevention of exposure to soils having total chromium or lead concentrations in excess of current action levels and to prevent migration of chromium and lead that would result in groundwater contamination.

Remedial action objectives developed for the contaminated buildings were to prevent exposure to indoor air or interior dusts/concrete having total chromium, hexavalent chromium, lead, arsenic, cadmium, manganese or nickel concentrations in excess of industrial health-based screening levels and to prevent migration of chromium and lead that could result in groundwater contamination.

The EPA has assumed that this facility will continue to be used for industrial or commercial purposes. The cleanup levels have been determined to allow future use of the facility as an industrial or commercial facility. The levels of contamination remaining on-site render the property unsuitable for other land uses, such as residential. Access restrictions would be implemented during remediation efforts to minimize exposure to humans.

4.2 Remedy Selection

The 1999 ROD concluded that the presence of lead in dust in on-site buildings and contamination on interior surfaces posed potential health concerns for industrial or commercial uses. The major components of the selected remedy for on-site buildings included the following:

- Institutional controls, as permitted by law, to prevent residential use of the site and buildings and to prevent removal of floors and soils beneath the building.

- Removal of contaminated interior concrete surfaces by grit blasting.

- Decontamination of building interiors by dusting, vacuuming, and wiping.

- Disposal of decontamination debris as appropriate, if necessary, at a Resource Conservation and Recovery Act (RCRA) facility.

The 1999 ROD also concluded that the presence of hexavalent chromium in the groundwater at the site presents a threat to any future on-site or off-site resident users of groundwater. The major components of the selected remedy for groundwater included the following:

- Institutional controls including deed restrictions, as permitted by law, to prevent use of contaminated groundwater.

- Active restoration of the aquifer by pumping and treating the contaminated groundwater.

- Treatment of contaminated groundwater by electrochemical reduction and precipitation techniques.

- Discharge of treated groundwater to the on-site tributary to Prairie Dog Creek. Alternatively and as appropriate, treated and untreated groundwater will be discharged to the local Colby, Kansas, publicly owned treatment works (POTW) and, at the option of state and local authorities, the treated groundwater may be beneficially reused rather than discharged.

- In situ bioremediation of contaminated groundwater is possible, as indicated by the results of treatability studies during design.

- Groundwater monitoring and periodic review of results.

The 2001 Amended ROD addresses groundwater hexavalent chromium, Cr VI, contamination in the groundwater. Evaluation of soil data determined that removal actions performed at the site have eliminated health concerns from exposure to contaminated surface soils at the site. In addition, the buildings that had metals contamination on the interior surfaces were demolished and removed from the site.

The presence of Cr VI in the groundwater at the site presented a threat to any future on-site or off-site residential users of groundwater. The major components of the selected remedy for groundwater as outlined in the September 2001 ROD (amendment to the May 1999 ROD) included the following:

- Institutional controls including deed restrictions, to the degree possible, to prevent use of contaminated groundwater.

- Active restoration of the aquifer by pumping and treating the contaminated groundwater.

- Treatment of contaminated groundwater by ion exchange.

- Discharge of treated groundwater to the on-site tributary to Prairie Dog Creek. Alternatively and as appropriate, treated and untreated groundwater will be discharged to the local Colby, Kansas POTW and, at the option of state and local authorities, the treated groundwater may be beneficially reused rather than discharged.

- Groundwater monitoring and periodic review of results.

- Provision of city water supply hookups to owners of affected residential wells by a water main and installation of meters and house connections.

4.3 Remedy Implementation

Although the 1999 ROD and 2001 Amended ROD are silent with respect to operable units, the remedy was implemented in two OUs: OU1, Buildings/Soil, and OU2, Groundwater.

OU1 consisted of the first phase of cleanup at the site and included cleaning and scarification of the floor surfaces in the plating and machine shop buildings as well as debris removal from inside and outside the buildings. Testing of the building interior surfaces showed that decontamination met the standards specified in the ROD. These buildings were later demolished during the OU2 to make room for the larger groundwater treatment equipment necessitated by the larger contamination plume.

OU2 consisted of two phases of cleanup at the site. The first phase for OU2 included demolition and removal of the existing plating and machine shop buildings and removal of contaminated soils. During the demolition, much more contamination was discovered in the concrete foundations of the building, and in the soil beneath the plating shop, than was originally anticipated. This soil was removed as deep as could be excavated (about 15 feet below grade) and the excavation was backfilled with clean soil. One area of the excavation did not meet the cleanup standards set in the ROD, but the EPA determined that the depth of the remaining contamination prevented exposure. The building slab over this area was considered to act as a cap to prevent precipitation or infiltration from causing further migration of the contamination due to leaching through the soils to the groundwater. The second phase of OU2 included construction of a new groundwater extraction and treatment system utilizing ion exchange to remove chromium from the extracted groundwater with discharge limits of 17ug/L hexavalent chromium and 100ug/L total chromium and a groundwater cleanup level of 100ug/L total chromium. In addition, private wells within and near the plume were connected to the city water system during OU2 site work.

The Remedy

A summary of how each of the components of the selected remedy was implemented at the site based on the ROD and the ROD Amendment is provided below following each set of bulleted items.

- Removal of contaminated interior concrete surfaces by grit blasting.

- Decontamination of building interiors by dusting, vacuuming, and wiping.

- Disposal of decontamination debris as appropriate, if necessary at a Resource Conservation and Recovery Act (RCRA) facility.

On-site construction activities began on November 30, 1999, and the final inspection for the remedial action for building decontamination was completed on February 24, 2000. Hazardous debris was collected from the machine shop and plating shop buildings and from outside the building areas. The machine shop and plating shop surfaces were dusted, wiped, vacuumed and/or scarified. Waste materials were recycled or disposed of in RCRA solid and hazardous waste facilities. These activities were documented in the Final Remedial Action Report: Buildings, BVSPC, 2000. The metal shop and plating shop were demolished as part of the groundwater treatment system installation presented below.

- Institutional controls, as permitted by law, to prevent residential use of the site and buildings and to prevent removal of floors and soils beneath the building.

- Institutional controls including deed restrictions, to the degree possible, to prevent use of contaminated groundwater.

Institutional controls have been implemented for the site through public education and warnings about use of the groundwater in the plume area. The city also has implemented a permit system which limits new wells within the city limits. The city has zoned the site as light industrial. Future use of the site is expected to remain commercial or industrial, and future foreseeable use of the site facility will be to house the treatment plant.

The 1999 ROD called for placement of deed restrictions to prevent future use of contaminated groundwater, to prevent residential use of the site and buildings, and to prevent removal of floors and soils beneath the building. These deed restrictions have not been implemented to date due to historical ownership concerns related to the purported conveyance of the Ace Services Inc. property to multiple trusts. This does not present a current protectiveness issue due to the operation of the groundwater treatment plant on-site.

- Active restoration of the aquifer by pumping and treating the contaminated groundwater.

- Treatment of contaminated groundwater by electrochemical reduction and precipitation techniques.

- In situ bioremediation of contaminated groundwater is possible, as indicated by the results of treatability studies during design.

- Treatment of contaminated groundwater by ion exchange.

Both the 1999 ROD and the 2001 Amended ROD envisioned active aquifer restoration through pump and treat remediation. In the 2001 Amended ROD, an ion exchange treatment process was chosen in lieu of the electrochemical process described in the 1999 ROD. This option was selected because of the increased amounts of extracted groundwater to be treated, the reduction in expected average concentrations in that water, and the associated change in cost-effectiveness in favor of ion exchange. A component of the 1999 ROD was an option to consider in situ bioremediation to enhance remediation efforts in the groundwater. This was eliminated given that it was determined to interfere with the ion exchange treatment system by creating an anaerobic environment in the groundwater affecting the performance of the system and requiring an additional ion exchange resin bed at significant additional cost. The benefits from the additional treatment did not justify the additional costs and performance reductions.

Design of the pump and treat system as outlined in the 2001 amended ROD was completed by BVSPC in January 2002. Prior to beginning construction, the existing machine shop, plating shop and underlying concrete slabs were demolished and removed. The demolition work also included removal of 1,000 cubic yards of soil contaminated with Cr VI from around the former troughs and foundation piers in the plating shop. This portion of the remedy eliminated the concern for exposure to contaminants within the existing buildings. The demolition effort is documented in the Demolition Summary Report, BVSPC, 2003.

The groundwater treatment system (GWTS) consists of a groundwater extraction system and a treatment plant. The groundwater extraction system is comprised of a total of 13 extraction wells screened in shallow, intermediate and deep zones of the aquifer. Twelve of the wells were built and one (PWS-8) is a former PWS well that was taken out of service due to chromium contamination. This well was retrofitted as an extraction well for the remediation system. The locations of the extraction wells were determined via computer flow modeling during the design phase to optimize control and capture of the chromium plume. Each well head is enclosed in a small heated and ventilated well house building. The well house also contains the motor control center; program logic control (PLC); remote terminal unit (RTU) cabinet; flow meter; modulating flow control valve; and all other piping, electrical, and control appurtenances for the well. Each well pumps into a buried HDPE pipeline system, which conveys the water to the influent storage tank at the groundwater treatment plant (GWTP). Each well is controlled from the PLC system in the main office at the GWTP via a fiber optic link.

The treatment plant is provided with two 250,000 gallon above-ground storage tanks. One tank stores raw groundwater from the extraction wells and the other tank stores treated water from the GWTP. The tanks provide about 4 hours of storage capacity to allow for flow balancing in the treatment system.

The GWTP uses an ion exchange system to remove hexavalent chromium from the extracted groundwater. The ion exchange system consists of two parallel process trains, each consisting of three ion exchange beds. Each bed is loaded with 560 cubic feet of Type II strong base anion exchange resin in chloride form. As water passes through the bed, the hexavalent chromium (as chromic acid) is exchanged for a chloride ion in the resin. Each three-bed train can be operated independently at any flow rate selected by the operator. The ion exchange system operates in a lead-lag configuration to provide full redundancy to assure that effluent quality is always met. In each train, contaminated groundwater flows through the lead bed where the chromium is removed. The water then flows through a lag bed, which serves as redundant backup in case there is some chromium breakthrough from the lead bed. The third bed in each train is in standby. Water does not flow through the standby bed. When the resin in the lead bed becomes fully saturated with chromium, the beds are advanced so the lag bed goes into lead service and the formerly standby bed goes into lag service. The spent resin in the former lead bed is then removed and replaced with new resin and that bed is placed in standby. Each process train is designed for a nominal flow of 250 gallons per minute (gpm) giving the plant a nominal capacity of 250 gpm if only one treatment train were to be operated. Final testing of the treatment system demonstrated that the actual capacity of the completed system is in excess of 1,100 gpm as determined by BVSPC in 2003.

A pair of raw water pumps (one per train) draws contaminated groundwater from the influent storage tank and pumps the water through a 5 micron filter, then through the treatment train and out to the effluent storage tank. Back wash, air pump, rinse, recycle, sluicing and transfer vessel systems are provided to facilitate resin management and transfer.

The treatment plant has large overhead doors at opposite sides which allow a full-sized 18 wheel tanker truck to park inside the building for resin transfers. This allows for the transfer of spent resin to a waste tanker and transfer of fresh resin from a tanker directly to the process vessels during any kind of weather and at any time of day.

The treated water effluent storage tank is provided with a dual outfall. The initial planned primary means of discharge from the effluent tank was via a gravity discharge to the adjacent tributary in Prairie Dog Creek. Alternatively, a pair of treated water pumps is provided to pump the effluent tank directly into the city drinking water system as approved by KDHE. A chlorination system is provided to chlorinate water pumped to the city system.

- Discharge of treated groundwater to the on-site tributary of Prairie Dog Creek, or alternatively and as appropriate, treated and untreated groundwater can be discharged to the local Colby, Kansas POTW and, at the option of state and local authorities, the treated groundwater can be, and is currently, beneficially reused rather than discharged.

The groundwater extraction and ion exchange treatment system started operation in August 2003. Treated groundwater was discharged exclusively to the tributary of Prairie Dog Creek until June 2005. When the system was considered to have proven effective for removing chromium to safe levels for human ingestion, the treated water was allowed to be transferred to the city public drinking water system. Since June 2005 the majority of treated water has been beneficially reused with transfer to the city public drinking water system. A total of 2.19870 billion gallons of groundwater have been treated by the site groundwater treatment system since startup through the audit number 25. A total of 1590.09 kilograms of chromium have been removed during treatment since startup through the audit number 25. From May 1, 2012 through October 29, 2012 95.505 million gallons of water were treated. A flow of 0.500 million gallons were discharged to the Prairie Dog Creek tributary with the remainder going to the city public water system during this time.

- Groundwater monitoring and periodic review of results

A semi-annual groundwater monitoring program that includes sampling all wells has been established for the site. This consists of sampling 48 monitoring wells, six observation wells, nine residential wells, the Ace recovery well at three depth intervals, 12 extraction wells and PWS-8 (the former PWS well). The samples are analyzed for total chromium and field parameters including temperature, specific conductivity, pH, turbidity, dissolved oxygen and oxidation-reduction potential. Monitoring wells are sampled using a conventional purge (three volumes or more) and sample method and extraction wells are sampled through a sample port. Laboratory analysis is provided by the EPA laboratory.

The results of the sampling events, and an evaluation of the performance of the extraction system in achieving cleanup of the groundwater, are provided in the Long-Term Response Action (LTRA) Cleanup Status Reports and Technical Memorandums submitted on a semi-annual basis as part of a contract with BVSPC.

- Provision of city water supply to owners of affected residential wells by a water main and installation of meters and house connections.

Public water was made available by KDHE to residents with private wells located within or in proximity to the chromium plume. The city of Colby provided a list of residential wells for connection to public water supply thereby eliminating this potential exposure pathway. Monitoring of the residential wells continues. Monitoring data indicate that the MCL for chromium was not exceeded in the monitored residential wells for the period covered by this five- year review.

4.4 Operation and Maintenance (O&M) Activities

The groundwater treatment facility was built and began operating on August 12, 2003. It has operated since that time except for an occasional power outage or equipment breakdown or an interruption due to volatile organic compound contamination from the High Plains Coop site. An interruption occurred for five days in October 2003 when 1,2-DCA contamination from the state-lead High Plains Coop site was found in wells EX-1I, EX-2I, and PWS-8. After five days, the groundwater treatment plant and the majority of the extraction wells were turned back on and continued operation. Extraction wells EX-1, EX-2 and PWS-8 remained offline until the High Plains Coop installed a granular activated carbon (GAC) system to remove the volatile organic compound prior to entering the Ace Services treatment system. EX-1I, EX-2I and PWS-8 extraction wells were brought back into operation in August 2004. The addition of the GAC system has had little impact on the operation of the Ace Services treatment system except for a more frequent need to change out the bag filters which become clogged with carbon fines shortly after their GAC system carbon change out is implemented.

Process monitoring is conducted twice daily, in the morning and the afternoon, at three locations: plant influent, plant effluent, and the effluent to the city. In the morning, an additional seven samplings are collected: downstream of the influent tank; downstream of the bag filter BF-1; downstream of the bag filter BF-2; downstream of ion exchange train A lead vessel; downstream of ion exchange train A lag vessel; downstream of ion exchange train B lead vessel and downstream of ion exchange train B lag vessel. All samples are analyzed for hexavalent chromium and pH. In addition, influent and effluent samples are analyzed for total chromium. The daily analysis of the samples is performed at the GWTP with a Hach kit. Once a week, the morning samples are split and sent to the independent laboratory contracted through an EPA cooperative agreement with the city.

A Long-Term Response Action audit is performed semi-annually by BVSPC under contract to the EPA which includes monitoring plant operations and evaluating the groundwater treatment plant and extraction system. The audit addresses equipment and operations associated with both the extraction and treatment systems. The audit includes a site visit to observe the city operators and obtain plant operating data. Any record keeping changes or needed repair and maintenance items are noted along with recommended follow up actions. BVSPC observations and recommendations are summarized in the audit reports on a semi-annual basis.

Following the semi-annual groundwater sampling events, a Cleanup Status Report (October 2012 groundwater data) or Technical Memorandum (April 2012 groundwater data) is prepared by BVSPC. These reports present the groundwater data and evaluate the effectiveness of the groundwater treatment and extraction system in remediating the chromium plume. Based on the groundwater data, extraction well pumping rates are modified as necessary to capture the target plume.

The annual O&M costs for the operation of the groundwater extraction and ion exchange treatment system by the city of Colby over the previous five- year review period from the year 2009 through the partial year of 2013 are shown in the following Table 2.

Table 2

Annual System Operations/O&M Costs

Year	Cost Estimate
2009	$550,766.26
2010	$711.649.73 (including extraction well EX-6-S cost)
2011	$684,397.81 (including cap construction cost)
2012	$601,883.39
2013	$61,293.68 (partial year costs)

5.0 Progress Since Last Review

This is the second five-year review for the site. During the last five years, progress has been made at reducing the size of the chromium plume that exceeds the action level which is the maximum contaminant level of 100ug/L total chromium. Figures 2-1 through 2-6 show total chromium isoconcentration contours for the shallow, intermediate and deep aquifer zones for the April and October 2012 data.

Groundwater sampling by BVSPC has continued on a semi-annual frequency over the last five years. In 2012 groundwater sampling was conducted in April and October. Table 2-2 shows the semi-annual analytical results summary. During April 2012 the wells exceeding the action level of 100ug/L were EX-6-S (1230ug/L); EX-1-I (207ug/L); PWS-8 (109ug/L); MW-14-I (131ug/L) and MW-9-I (154ug/L). During the October 2012 sampling event only EX-6-S (297ug/L) and MW-14-I (150ug/L) exceeded the action level of 100ug/l.

During the April 2012 sampling event the HydraSleeve sampling technique was utilized for 2 monitoring well nests that are comprised of 6 monitoring wells in order to compare the results of analyses in anticipation of utilizing a cost savings. The HydraSleeve sampling device is a method of groundwater collection from the screened interval of a monitoring well without having to purge the well prior to sample collection. The HydraSleeve sampling device collects groundwater from a specific zone of the well column (approximately a 30-inch zone) whereas the pump/purging method pulls water preferentially from the most permeable zone of the aquifer in which the well screen and filter pack are placed. Replicate samples were collected, one sample from each well was collected using a new HydraSleeve sampler and the second sample from the well was collected by low-flow purging techniques using a submersible pump. The results of the two sampling methods were compared and assessed to see if the HydraSleeve sample method is comparable to the low-flow purge method. The results of the two methods were compared using the relative percent difference (RPD) evaluation with a goal of an RPD of plus or minus 20 percent. The RPDs for the two methods were outside the RPD goal for 4 of the 6 results pairs, indicating that the two methods are not comparable sample methods for the Ace Services site. Re-analysis of the samples by the EPA laboratory confirmed the reported results as valid. The reason for the discrepancies in the replicate results may be that the HydraSleeve sampler collects groundwater from a discrete zone of the aquifer whereas the pump/purge sampling method

collects a composite groundwater sample from throughout the screen and filter pack. Based on the results of this evaluation the HydraSleeve sample method may not be applicable at the Ace Services site without additional testing and evaluation (BVSPC). The method was not utilized again during the next October 2012 sampling event.

A Cleanup Status Report was written by BVSPC presenting the October 2012 groundwater sampling data to evaluate the effectiveness of the groundwater treatment and extraction system in remediating the chromium plume. Based on the evaluation, extraction well pumping rates are modified as necessary to capture the target plume. The target plume varies depending on the most recent groundwater data. It is important to monitor the plume and make strategic changes in extraction well pumping rates in order to conserve water and energy.

As pumping rates have been varied or selected wells shut off due to reduced chromium concentration or low regional groundwater level conditions, some rebound in concentrations has occurred over the years. Extraction well EX-6-S has shown persistent concentrations above the action level and is located nearest to the source area.

The first optimization study was conducted and a remedial system evaluation report was completed in 2007. A recommendation of the remedial system evaluation report was that a source area evaluation should be completed. A source area evaluation report was generated by BVSPC in 2009 including the areas of highest soil contamination at depth. Several options for optimization and additional remedial measures were considered and reviewed by the site team in 2009.

As a result of the first optimization study, additional remedial measures were taken as follows:

- In 2010 an additional extraction well, EX-6-S, was installed in the area of the highest soil and groundwater contamination which is the area of the former on-site lagoon.

- A synthetic geomembrane cover was constructed over the former lagoon area in May 2011 in order to inhibit further migration of contaminants into the aquifer.

An Explanation of Significant Differences (ESD) was completed by the EPA on April 9, 2012 which included the follow up remedial measures which resulted from the optimization study. The ESD summarized the installation of the new extraction well, EX-6S, in the area of highest soil and groundwater contamination, and the construction of the synthetic geomembrane cover over the former lagoon area.

A second optimization was initiated in June 2012 to examine the remedy once more in anticipation of the ending of the LTRA period and the beginning of the Operation and Maintenance (O&M) period when the KDHE takes over the management of the site. This second optimization resulted in the EPA HQ contractor, Tetra-Tech, recommending in the 2012 optimization review memorandum that the extraction wells should be maintained at prescribed pumping rate levels in order to manage the groundwater plume effectively. The EPA agreed to incorporate the recommended pumping rates. The HQ contractor also recommended that packers be installed in wells EX-5-I/D and PWS-8 and recommended the MW-12D well for abandonment which was agreed to. The purpose of the packers in the wells was to pull chromium contamination from the intermediate zone of the aquifer and to isolate the deep aquifer which is clean. Instead of turning off certain extraction wells as the contamination was reduced as had been the custom, the EPA HQ contractor recommendation was to continue the pumping

rates and turn down wells near the toe of the plume as contamination is reduced while continuing to pump the upgradient wells. In the future this optimization technique is to turn off wells gradually from downgradient to the upgradient direction until the contamination has been reduced. Pumping rates were increased with a goal of 20 ppb to account for rebound as recommended and packers were installed in EX-5-I/D and PWS-8.

In June 2012 variable frequency drives were installed in extraction wells EX-1-I; Ex-2-I; EX-3-I; EX-5-I/D; EX-6-S and PWS-8. BVSPC recommended pumping rates in the April 2012 Data Evaluation Memorandum (June 29, 2012) based on utilizing the newly installed variable frequency drives to achieve lower well flows than previously possible. BVSPC provided an estimate of annual savings from the retrofit of extraction well pumps with variable frequency drives. The variable frequency drives allow the pumping rate of the pump in the extraction well to be reduced without the overheating of the pump. Some wells were pumping at less than full capacity and after installation of the variable frequency drives, an energy savings over time is anticipated. In the future operation of the extraction wells during the O&M phase, utilizing a lower pumping rate for extraction wells will be a lower power cost and an energy savings. The design specifications and the installation of the variable frequency drives were provided under the EPA contract with BVSPC.

In July 2012 an investigation was conducted of the background chromium concentration in area groundwater wells by BVSPC. Background total Cr and Cr VI samples were collected on July 31, 2012, from seven of the city of Colby's public water supply wells and five domestic wells at distances located between 0.5 and 3 miles upgradient or crossg radient to the Ace Services site. Samples were then analyzed for very low detection limits. Background concentrations were established by calculating the 95 percent upper concentration levels (UCL) of each data set. Calculated results using the UCL indicate the background concentrations for total Cr and Cr VI in groundwater in the Colby, Kansas area are: 1.8ug/L for total Cr and 1.5ug/L for Cr VI. These values may vary somewhat as concentrations change.

On July 18, 2012 a Technical Memorandum was produced by BVSPC for VOC Effluent Sampling and Analysis Evaluation. On January 17, 2012, the EPA had forwarded BVSPC a memorandum dated November 2011 discussing the detection of manufacturing residuals in the effluent of certain anion resins that were being used in other EPA regions. The residuals that were detected included volatile organic compounds (VOC), including 1, 2-dichloroethane (DCA); methylene chloride; vinyl chloride; chlorobenzene and chloroform. Four rounds of VOC analysis of the effluent stream from the Ace Services groundwater treatment plant would be collected to evaluate for the presence of VOCs. The Ace Services groundwater treatment plant originally used Purolite A300 Type II Strong Base Anion exchange resin but because of quality problems, including VOC contamination, it was replaced in 2005 with Dow's DOWEX SAR Type II Strong Base Anion exchange resin. When the switch to the DOW resin was made, BVSPC instituted QA testing protocols for every batch of resin to be delivered to the plant. The testing requires that each batch of resin pass a 16-hour soak test to evaluate VOC leachability from the resin. BVSPC also requires the resin to be partially converted to the bicarbonate form from the original chloride form which helps reduce the temporary pH depression as the resin is first brought online (BVSPC). Effluent samples collected as part of the routine O&M QA program at the Ace Services groundwater treatment plant were also analyzed for VOCs listed on the EPA Target Compound List (TCL). The groundwater has two parallel treatment trains. Only one train is operated at a time. The treatment trains are alternately operated monthly causing the resin in the off-line train to soak for over a month. Four samples were collected over a three month period at times when the treatment trains were switched into service and also when the resin was changed out. Sampling at these intervals allowed sample collection from the portion of the effluent that first flows through the pre-soaked resin vessel.

It was anticipated that if residual VOCs were present in the resin that the VOCs would be present in the first portions of discharge from the resin vessel. Results of the VOC analyses for all four sample events were nondetect for all VOCs for all four sample events. The results confirm the anticipated quality of the effluent produced from the Ace Services groundwater treatment plant resin as being free of VOCs (BVSPC).

In October 2012 well rehabilitation with chlorine and hydrochloric acid treatment was conducted for wells EX-1-I; EX-2-I; EX-3-I; EX-5-I/D; EX-6-S and PWS-8 by BVSPC. This procedure is conducted to maintain optimum well efficiency, to inhibit well fouling from bacterial growth or chemical precipitation in the screened portion of the well.

6.0 Five-Year Review Process

6.1 Administrative Components

The second five-year review was conducted by the EPA. The five-year review began on September 19, 2012 with a review of the site file.

6.2 Community Involvement

A display advertisement will be prepared following the completion of the Five-Year Review Report. The display advertisement will be placed in the *Colby, Kansas Free Press*. A copy of the final 2013 Five-Year Review Report will be placed in the site repository in Colby, Kansas and will be included on the EPA Superfund five- year review website.

6.3 Document Review

- Documents reviewed as part of the five-year review included the following:
    - Record of Decision, USEPA Region 7, May, 1999
    - Amended Record of Decision, USEPA Region 7, September, 2001
    - Interim Remedial Action Report, BVSPC, September, 2003
    - Preliminary Close Out Report, USEPA Region 7, September, 2003
    - Technical Memorandum, Ace Services LTRA, VOC Effluent Sampling and Analysis Evaluation, BVSPC, July 18, 2012
    - Technical Memorandum, Ace Services LTRA, HydraSleeve Sampling Evaluation, BVSPC, August 17, 2012
    - Optimization Review Memorandum, Tetra-Tech, November 1, 2012

- Long Term Response Action, Audit Report Numbers 16 through 25, BVSPC
- Long Term Response Action, Cleanup Status Report Numbers 11 through 14, BVSPC

6.4 Data Review

Groundwater Monitoring Data

Groundwater monitoring has been conducted for site monitoring wells, extraction wells, and residential wells and analyzed for total chromium to determine the plume extent. Data summary tables for monitoring data are included in Attachment A. Groundwater elevations were measured in all monitoring wells and extraction wells to evaluate the capture zone of the extraction field. Groundwater elevations in wells were determined from water level measurements made on April 9, 2012, and October 22, 2012. The groundwater elevations are provided for April 2012 and October 2012 in Figure 2-7 and Figure 2-8. Historical groundwater elevation data for the site show a drop in groundwater elevation of approximately 15 feet since 1996 when the EPA initiated the remedial investigation. The decline in groundwater elevation at the site has resulted in several shallow wells being turned off. The decline is attributed to operating extraction wells at the site as well as a regional decrease in groundwater elevation.

Over the last five years and since the start up of the extraction system in August 2003, there has been a reduction in the extent of the plume exceeding the 100ug/L total chromium action level. In each of the three aquifer zones, the area of the plume exceeding 100ug/L has been reduced. There have been occasional concentration fluctuations and spikes experienced in some monitoring and extraction wells, but in general, the chromium concentrations have shown a downward trend. The highest levels have been associated with the former lagoon area. The extraction well EX-6-S installed in 2010 in the former lagoon area has shown the highest levels recently.

Performance of the system is periodically evaluated and adjustments to pumping rates are made to optimize capture of the plume. The general practice has historically been to turn off extraction wells when the chromium concentration is reduced below the action level of100ug/L. During the second optimization in 2013, the HQ contractor, Tetra-Tech, recommended the reduction of the pumping rate in EX-5I/D near the toe of the plume and continued increase in the pumping rate of extraction wells upgradient near the groundwater treatment plant. The EPA adopted this recommendation. The strategy is to decrease the pumping rate from the downgradient area of the plume gradually to the upgradient area near the plant until the extraction wells can be turned off.

In April 2012 five wells exceeded the cleanup goal for total chromium. EX-1-I had a concentration of 207ug/L which was a decrease from the concentration of 226ug/L in October 2011. The chromium concentration of PWS-8 decreased from the concentration of 202ug/L in October 2011 to 109ug/L in April 2012. Extraction well EX-6-S increased from 643ug/L in October 2011 to 1230ug/L in April 2012. Well MW-9-I increased from 21.4ug/L in April 2011 to 154ug/L in April 2012. Well MW-14I increased to 131ug/L in April 2012 from 98.1ug/L in April 2011. Well MW-14-I is located near the extraction well EX-5-I/D near the toe of the plume.

During the October 2012 sampling two wells exceeded 100ug/L. Well MW-14-I increased from131ug/L in April 2012 to150ug/L in October 2012. Extraction well EX-6S decreased from 1230ug/L in April 2012 to 297ug/L in October 2012.

Chromium concentrations in residential wells continue to remain below detection or continue to decrease as indicated in Table 2-2.

Background total Cr and Cr VI have been determined for the site. Background groundwater samples were collected by BVSPC on July 31, 2012, from seven city of Colby public water supply wells and five domestic wells at distances located between 0.5 and 3 miles upgradient or crossgradient to the site. Samples were analyzed at very low detection limits. Background concentrations were established by calculating the 95 percent upper concentration levels (UCL) of each data set. Calculated results using the UCL indicate the background concentrations for total Cr and Cr VI in groundwater in the Colby, Kansas area are: 1.8ug/L for total Cr and 1.5ug/L for Cr VI. These values are subject to variability.

The capture zone of the well field has been interpreted by BVSPC using groundwater potentiometric surface maps and groundwater flow rate calculations. The potentiometric maps for the site are shown in Figures 2-1, 2-2 and 2-3 for the April 2012 sampling event and in Figures 2-4, 2-5 and 2-6 for the October 2012 sampling event. The potentiometric maps were prepared using GIS software with a contour extension which provides a statistical approximation of the groundwater table contour. The 100ug/L total chromium isoconcentration contours for the shallow, intermediate and deep zones are shown in Figures 2-1 to 2-6. The capture zone created by the extraction field has created hydraulic control of the target chromium plume. The chromium plume has significantly reduced in extent since startup of the treatment system.

Treatment Plant Effluent

Effluent discharge, whether discharged to the tributary of Prairie Dog Creek or to the city public water system, is sampled daily with the Hach test kit. This test provides an early indication of possible problems with the system. Samples collected each week are split with one split sent to an off-site laboratory for analysis. Most, if not all, of the chromium in the effluent is in the Cr VI form. The discharge limits are 17ug/L hexavalent Cr and the MCL, 100ug/L total Cr. Off-site laboratory effluent sample results have been nondetect for Cr VI with detection levels of 2ug/L. Treated water from the groundwater treatment plant goes to the tributary of Prairie Dog Creek or directly to the distribution system for the city. The water goes to the water tower to be blended with other water from other water supply wells that the city operates. The city does not have a central water treatment system. The city chlorinates the water at the wellhead and this water then goes into their water supply system.

6.5 Site Inspection

A site inspection was performed on October 30, 2012, by BVSPC, during the October semi-annual audit of the performance of the groundwater treatment plant and extraction wells. The building interior including the ion exchange groundwater treatment plant components and the plant laboratory, as well as the exterior areas, the influent and effluent tanks, the geomembrane capped area and the extraction wells were inspected. Site photographs taken during this inspection are shown in Attachment C.

7.0 Technical Assessment

The five- year review must determine whether the remedy at a site is protective of human health and the environment. The EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information and to ensure all relevant issues are considered when determining the protectiveness of a remedy. These questions are assessed for the site in the following paragraphs. At the end of the section is a summary of the technical assessment.

7.1 Question A: Is the remedy functioning as intended by the decision documents?

Yes.

7.1.1 Remedial Action Performance

The performance of the remedy has been evaluated with groundwater monitoring, evaluation of plume capture, treatment process monitoring and evaluation of extraction well performance.

Groundwater monitoring is performed on a semi-annual basis and the data are evaluated for system performance and effectiveness. The sampling and evaluation are performed by BVSPC under contract to the EPA. Based on the results of the monitoring, pumping rates for the extraction wells have historically been adjusted as necessary in response to plume concentrations, aquifer conditions and available well yield to capture the target plume.

The ion exchange groundwater treatment plant performance has been monitored by BVSPC during semiannual audits of the system. The city of Colby operates the groundwater treatment plant under a cooperative agreement with the EPA. The treatment plant operation and maintenance by the city was evaluated by BVSPC during an audit of the plant and extraction system on October 29 through October 31, 2012.

A total of approximately 2.1987 billion gallons of water has been treated to date since the groundwater treatment plant startup through the end of the audit period 25 conducted October 29 through October 31, 2012. A total of 1590.09 kilograms of chromium have been removed since startup of the groundwater treatment plant through the end of audit period 25. From May 1, 2012 through October 29, 2012 the system treated 95.505 million gallons of water. A flow of 0.500 million gallons was discharged to the Prairie Dog Creek tributary with the remainder going to the city of Colby drinking water system during this time.

The EPA began the first optimization study and a remedial system evaluation report was completed in 2007. An evaluation of the source area was a recommendation of the optimization study. A source area evaluation report was generated by BVSPC and reviewed by the site team in 2009. Options for further remedial measures were considered by the site team. In 2010 an extraction well, EX-6-S, was installed in the area of highest soil contamination at depth and the area of highest groundwater contamination. In 2011 a synthetic geomembrane cover was constructed over the area of the highest contamination, the former lagoon area.

A second optimization study was initiated in 2012 in anticipation of the end of the LTRA and the beginning of the O&M phase when the state takes over the operation of the treatment plant. The EPA HQ optimization contractor, Tetra-Tech, recommended changes in the pumping rates of the extraction wells with a target pumping goal of 20 ppb to account for rebound, the installation of packers in wells PWS-8 and EX-5-I/D and abandonment of MW-12-D. The EPA and the site team agreed to these recommendations. The pumping rates of the extraction wells were changed to sustain the pumping rate at the upgradient end of the plume near the treatment plant and near EX-1-I. The optimization recommendation was to gradually decrease the pumping rate from the downgradient plume area of EX-5-I/D toward the upgradient direction until the chromium concentration decreases to below the action level.

7.1.2 System Operation and Maintenance

The groundwater extraction and treatment systems are operated and maintained by the city of Colby under a cooperative agreement with the EPA. BVSPC provides periodic technical oversight of both systems to evaluate and optimize the effectiveness of the groundwater extraction and to monitor plant operations to ensure operator conformance with specified requirements for system operation. Findings from this oversight are documented in an LTRA audit report semi-annually.

The LTRA audit reports completed by BVSPC provide an evaluation of O&M of the extraction well system and the groundwater treatment system. The audits review system operation, maintenance records, monitoring records and evaluate ways to optimize operations. Problems and anomalies regarding operation of the well field and treatment system are identified in each audit report along with recommendations to correct the problems.

Semiannual groundwater sampling results are evaluated by the BVSPC in the Cleanup Status Reports including the effectiveness in remediating the groundwater plume.

The groundwater treatment plant audit reports prepared by BVSPC over the last five years indicate that the groundwater treatment plant and extraction wells have been efficiently operated and maintained by the city of Colby. The O&M manual, plant operation records, monitoring results and maintenance logs are available at the site. The audit reports include flow and chromium removal summary calculations as well as the treatment plant discharge to city water system and the tributary to Prairie Dog Creek and resin cost per gallon for each audit period. Effluent results indicate that the treatment plant has been effectively removing chromium to below the discharge standards. Discharge standards are 17ug/L hexavalent chromium and 100ug/L total chromium.

The State Superfund Contract signed on January 3, 2003, states that "After the first ten years of operation, O&M will be the responsibility of the KDHE." The site will transfer to the KDHE for the O&M phase.

7.1.3 Opportunities for Optimization

General system optimization has been achieved with the adjustment of the pumping of different extraction wells and changing the pumping rates to most efficiently reach remediation goals. Sampling frequencies and extraction well pumping rates have been modified as appropriate following data review.

The first optimization study remedial system evaluation report was completed by the EPA in September 2007. A source evaluation was conducted in response to optimization recommendations and a source evaluation report was completed by BVSPC in 2009. The source evaluation report was reviewed by the site team and options for further remedial measures were considered. In 2010 an additional extraction well, EX-6S, was installed in the area of highest soil and groundwater contamination which is the area of the former lagoon. In 2011 a synthetic geomembrane cover was constructed over the former lagoon area in order to inhibit further migration of contaminated groundwater into the aquifer.

A second optimization was initiated in 2012 by the EPA in anticipation of the end of the LTRA phase and the beginning of the O&M phase and the upcoming takeover of the O&M of the groundwater treatment plant by the state of Kansas, KDHE. The optimization recommendations received from the EPA HQ contractor, Tetra-Tech, included modifications in extraction well pumping rates, installation of packers in two extraction wells and abandonment of well MW-12-D. The purpose of the installation of the packers in the extraction wells was to draw from the intermediate zone of the aquifer and to isolate the deep aquifer which is clean. The optimization recommendation included increasing the pumping of the extraction wells near the groundwater treatment plant with a pumping goal of 20 ppb to account for rebound and reducing the pumping rate from the extraction well, EX-5I/D, near the toe of the groundwater plume. The recommendations of the EPA HQ contractor were accepted by the EPA and the site team in 2013. The optimization recommendation is to gradually reduce the pumping rate from the toe of the groundwater plume, from downgradient to upgradient, until the chromium concentration is reduced below the maximum contaminant level.

A groundwater model statement of work has been completed to include a study by the EPA Office of Research and Development (ORD) to provide a current status of the chromium plume on-site and to provide estimates for the approximate length of the remaining time for cleanup of the groundwater plume.

7.1.4 Early Indicators of Potential Issues

Although equipment breakdowns have occasionally occurred, the BVSPC has provided technical support and problems have been attended to and repaired in a timely manner by the city of Colby. There have been no repair or maintenance issues that have had a significant negative impact on the performance of the remedy.

7.1.5 Implementation of Institutional Controls and Other Measures

Institutional controls have been implemented for the site through public education and warnings about use of the groundwater in the plume area. The city also has an institutional control in place in the form of a permit system which limits new wells in the city in order to prevent future use of contaminated groundwater. The site property is zoned as light industrial. Future use of the site is expected to remain commercial or industrial, and future use of the site facility will be to house the treatment plant.

Placement of Kansas Environmental Use Controls (EUC) would prevent future use of the site for anything other than commercial or industrial use. A Kansas EUC has not been placed due to historical ownership concerns related to the purported conveyance of the Ace Services Inc. property to multiple trusts. At this time there is no known contact information for the trustee of the trusts. This does not present a current protectiveness issue due to the operation of the groundwater treatment plant on site.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection still valid?

Yes.

7.2.1 Changes in Exposure Pathways

- Has land use or expected land use on or near the site changed (e.g., industrial to residential, commercial to residential)?

  Land use has not changed at or near the site and any potential future land use changes have not been observed.

- Have any human health or ecological routes of exposure or receptors changed or been newly identified (e.g., dermal contact where none previously existed, new populations or species identified on-site or near the site) that could affect the protectiveness of the remedy?

  No new exposure pathways have been identified that would affect the protectiveness of the remedy. Also, as noted previously, exposure scenarios involving contact with residual contamination in the plating buildings are no longer valid as the buildings have been removed. Public water has been made available by KDHE to residents with private wells located within or in proximity to the chromium plume. The city of Colby provided a list of residential wells and the private wells identified by the city were offered to connect to public water supply. A majority of the residents with private wells chose to switch to public water thereby eliminating this potential exposure pathway. Monitoring of all the residential wells continues. Private wells discontinued for potable use and private wells used as a potable water supply are still monitored. Monitoring data indicate that the MCL has not been exceeded in the residential wells in the last five years. No other changes to previously identified receptors and routes of exposure have been identified that would affect the protectiveness of the remedy.

- Are there newly identified contaminants or contaminant sources?

  The available data do not demonstrate new contaminants or contaminant sources.

- Are there unanticipated toxic byproducts of the remedy not previously addressed by the decision documents (e.g., byproducts not evaluated at the time of remedy selection)?

  No unanticipated toxic byproducts of the remedy have been identified.

- Have physical site conditions (e.g., changes in anticipated direction or rate of groundwater flow) or the understanding of these conditions (e.g., changes in anticipated direction or rate of groundwater flow) changed in a way that could affect the protectiveness of the remedy?

In October 2003 it was discovered that extraction wells EX-1I, EX2I and PWS-8 contained VOCs originating from the High Plains Cooperative, a state-lead site located upgradient from the site. The extraction wells affected, EX-1, EX-2I and PWS-8, were shut off until the KDHE and Hi-Plains Coop installed a granular activated carbon (GAC) system to pretreat the VOC contaminated groundwater prior to entering the site treatment plant. The groundwater treatment plant continued to operate and the majority of the extraction wells continued pumping with the treated effluent going to the tributary of the Prairie Dog Creek while the GAC system was being constructed. The three extraction wells taken offline were returned to pumping after the GAC system was operating. This was a short-term measure and did not have an impact on the protectiveness of the remedy.

7.2.2 Changes in Standards, Newly Promulgated Standards, To Be Considered

- Have there been changes to risk-based cleanup levels or standards identified as Applicable or Relevant and Appropriate Requirements (ARARs) in the ROD that call into question the protectiveness of the remedy?

  No. The cleanup levels are still valid or no longer relevant because of the removal and remedial actions taken. The Cr VI groundwater cleanup level, the federal MCL, 100ug/L is still valid. The remedy for soil remains protective because exposure to chromium in soil is an incomplete pathway. The lead cleanup standard is less than the industrial worker screening level of 800 milligrams per kilogram (mg/kg). The cleanup levels for indoor air and interior dust/concrete are no longer valid because the plating buildings containing residual contamination (for which the standards were developed) have been removed. Therefore, there is no need to evaluate indoor air or interior dust/concrete cleanup levels.

  The site cleanup level is the MCL for total chromium, 100ug/L, and is identified as an ARAR. Therefore, the remedy for groundwater remains protective.

7.2.3 Changes in Toxicity and Other Contaminant Characteristics

- Have toxicity factors for contaminants of concern at the site changed in a way that could affect the protectiveness of the remedy?

Chromium VI was the only contaminant evaluated quantitatively in the 1998 baseline risk assessment. All other compounds (lead, arsenic, etc.) were evaluated qualitatively. The chromium VI oral and dermal reference doses (RfDs) used in the 1998 baseline risk assessment are no longer valid. For a comparison, see Table 3. Also, the recommended gastrointestinal absorption factor used to derive the dermal RfD has changed per Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) (USEPA, 2004). Despite these changes in toxicity values, they are not expected to affect the protectiveness of the remedy as the cleanup level for groundwater is based on the MCL.

Table 3.Evaluation of Toxicity Values

Toxicity Values	1998 Baseline Risk Assessment	Current Guidance and Policy
Chromium VI Oral RfD	5E-03 mg/kg-day	3E-03 mg/kg-day
Gastrointestinal Absorption Efficiency	0.5	0.025
Chromium VI Dermal RfD	2.5E mg/kg-day	7.5E-05 mg/kg-day

The ROD selected 100ug/L of total chromium as the cleanup level for the aquifer. The effluent performance standards are 100ug/L for total chromium and 17ug/L for hexavalent chromium. The current system effectively removes hexavalent chromium to drinking water standards with the ion-exchange treatment train. No new wells are being installed within the plume because of the city institutional control permit system for any new wells. Residential well sampling results are well below the drinking water standard. The remedy is currently protective.

- Have other contaminated characteristics changed in a way that could affect protectiveness of the remedy?

  There have been no changes in contaminant characteristics that could affect the protectiveness of the remedy.

7.2.4 Changes in Risk Assessment Methods

- Have standardized risk assessment methodologies changed in a way that could affect the protectiveness of the remedy?

  Standardized risk assessment methodologies have changed since the 1998 baseline risk assessment and ROD, but they have not changed in a way that could affect the protectiveness of the remedy. Table 4 illustrates the changes in risk assessment methodologies with the most significant change involving the exposure receptor and exposure duration. As a result of these changes in exposure factors, as well as toxicity values, the hazard indices in the 1998 baseline risk assessment were underestimated approximately four-fold. However, previously estimated hazard indices (i.e., future groundwater pathway) already exceeded acceptable levels requiring remedial action.

Table 4.Evaluation of Exposure Factors and Impacts on Risk Estimates

Exposure Factors	1998 Baseline Risk Assessment	Current Guidance and Policy
Surface Area Adult	18,200 cm^2	18,000 cm^2
Surface Area Child	7,200 cm^2	6,600 cm^2
Exposure Time Adult	0.2 hour/day	0.58 hour/day
Exposure Time Child	0.2 hour/day	1 hour/day
Exposure Duration Receptor	30 years, time-weighted average (6 years as child and 24 years as an adult)	6 years, child

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

7.3.1 Ecological Risks

An ecological risk assessment was completed. No complete exposure pathways were determined to exist and therefore ecological risk was not considered in developing cleanup levels for the site. Results of sediment sampling conducted by KDHE in 1989 in the unnamed tributary of Prairie Dog Creek do not exceed the current chromium ecological screening level for toxicity to macroinvertebrates (43.4 mg/kg) as taken from the "Development and Analysis of Sediment Quality Guidelines for Freshwater Ecosystems" by D. MacDonald, C.G. Ingersoll, and T.A. Berger, published in 2000.

The ecological risk assessment did not consider the pathway associated with treated groundwater discharged to Prairie Dog Creek. If flow from this discharge created a continuous flow, then chronic criteria would be appropriate. If discharge created an intermittent flow, then acute criteria would be appropriate. The current discharge standards for hexavalent chromium (17ug/L) do meet the chronic or acute levels of the National Ambient Water Quality Criteria (NAWQC) for protection of aquatic life. The chronic NAWQC standard for hexavalent chromium is 11ug/L and the acute standard is 16ug/L.

After reviewing discharge records it was found that the flow to the tributary is not continuous and discharge levels have all been below detectable levels with a detection limit below both the chronic and acute NAWQC standards for hexavalent chromium. Therefore, as currently operated, the remedy is ecologically protective.

7.3.2 Natural Disaster Impacts

No known natural disasters have occurred that would affect the protectiveness of the remedy.

7.3.3 Any Other Information That Could Call Into Question the Protectiveness of the Remedy

There is no other information found in this five-year review that would call into question the protectiveness of the remedy.

7.4 Technical Assessment Summary

Significant progress has been made at attaining the remediation goals at the site. Site conditions are evaluated with semiannual groundwater sampling by BVSPC. Pumping rate adjustments are made to the extraction wells in response to increases or decreases in chromium levels. BVSPC conducts on-site semiannual audits of the groundwater treatment plant and extraction wells and submits audit reports under their contract with the EPA. Groundwater treatment plant repairs are made when required and ion exchange resin is supplied periodically with funding under the cooperative agreement between the city and the EPA. The groundwater treatment plant and the extraction wells are well maintained by the city of Colby to ensure continuous operation and protectiveness. There have been no significant shutdowns of the treatment plant and there have not been any negative impacts on the protectiveness of the remedy. A total of 2.1987 billion gallons of groundwater have been treated from startup of the groundwater treatment plant through audit report period 25 by the site groundwater treatment plant and extraction wells. A total of 1590.09 kilograms of chromium have been removed during treatment from startup of the plant through audit report period 25.

Following the first optimization study which recommended additional investigation of the source area of the site, an additional extraction well, EX-6-S, was installed in 2010 in the area of highest soil and groundwater contamination and a synthetic geomembrane cover was constructed in 2011 over the former lagoon, the area of highest soil and groundwater contamination.

A second optimization study was conducted by the EPA in 2012 and recommendations from the EPA HQ contractor, Tetra-Tech, resulted in implementing higher extraction rates in upgradient wells nearest the treatment plant with a pumping goal of 20ug/L in order to account for rebound and installation of packers in two extraction wells, PWS-8 and EX-5 I/D, in order to concentrate pumping of groundwater from the intermediate aquifer area and to isolate the deep aquifer which is clean.

The remedy at the site protects human health and the environment. Exposure pathways to groundwater have been curtailed because of the connection of private residential wells to the city public water supply system. The contaminated groundwater plume has been reduced to a few localized areas above the action level. An institutional control, a permit requirement for installation of new wells, protects the site and the site is zoned light industrial.

8.0 Issues

Table 5 Issues

Issue	Affects Protectiveness Current	 Future
A deed restriction not in place on site property to control future use of the site.	No	Yes

9.0 Recommendations and Follow-up Actions

Table 6 Recommendations and Follow-up Actions

Issue	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
1	When groundwater remediation is complete, re-evaluate the need for additional institutional controls.	EPA/KDHE	EPA/KDHE	September 30, 2018

10.0 Protectiveness Statements

Operable Unit 1

The remedy for OU1 is currently protective of human health and the environment in the short term. The metal and plating shop buildings remedy included scarification of the floor surfaces in the plating and machine shop buildings as well as debris removal from inside and outside the buildings. OU1 actions were conducted in accordance with site decision documents. The exposure pathways and the site buildings for OU1 no longer exist and were removed as part of OU2.

Operable Unit 2

The remedy at OU2 protects human health and the environment. The metal and plating shop buildings and foundations were removed. Soils beneath these structures were excavated to a depth of 15 feet below grade. The ion exchange groundwater treatment plant was constructed and the extraction wells were installed. The groundwater treatment building serves as a cap over residual soils beneath the building.
The groundwater contaminant plume has been reduced by the extraction wells pumping and ion

exchange groundwater treatment plant operation over the LTRA throughout the last ten years. Downgradient private well receptors have been provided an alternate water supply and the remaining private wells are monitored semiannually.

The first optimization study recommended a source area evaluation in 2007. A source area evaluation report was produced by BVSPC in 2009 and the report provided information about the area of highest soil contamination. Options for additional remedial measures were evaluated. An additional extraction well, EX-6-S, was installed in 2010 in the area of highest soil and groundwater contamination. In addition a synthetic geomembrane cover was constructed in 2011 over the former lagoon area, the area of highest residual soil contamination at depth and the area of highest groundwater contamination.

A second optimization study was initiated in 2012 in anticipation of the end of the LTRA and the beginning of the O&M phase when the state of Kansas takes over the management of the site. Recommendations of the second optimization included increases in pumping rates at upgradient wells and a gradual decrease in pumping rates from the downgradient to upgradient direction until the contamination is reduced below a pumping goal of 20ug/L in order to account for rebound. An additional recommendation of the second optimization was the installation of packers in two extraction wells in order to extract groundwater from the intermediate zone of the aquifer and isolate the deep zone which is clean. The packers were installed in EX-5-I/D and PWS-8 and the recommended pumping rates were implemented.
Site Wide

The city of Colby has provided public education about use of the groundwater in the site plume area. The city has implemented an institutional control, a permit system, which limits new wells in order to control future groundwater use. The city has zoned the site as light industrial. Future use of the site is expected to remain commercial or industrial and future use of the site facility will be to house the treatment plant. A decision will be made to evaluate whether a deed restriction can be pursued and placed without disruption of the treatment system operation. A current protectiveness issue does not exist because of the operation of the groundwater treatment plant.

Because the remedial actions at OUs are currently protective, the site is currently protective of human health and the environment in the short term. A decision will be made to evaluate whether a deed restriction can be placed without disruption of the treatment system operation.

11. Next Review

The next five-year review for the Ace Services site is required five years from this five-year review in the year 2018.

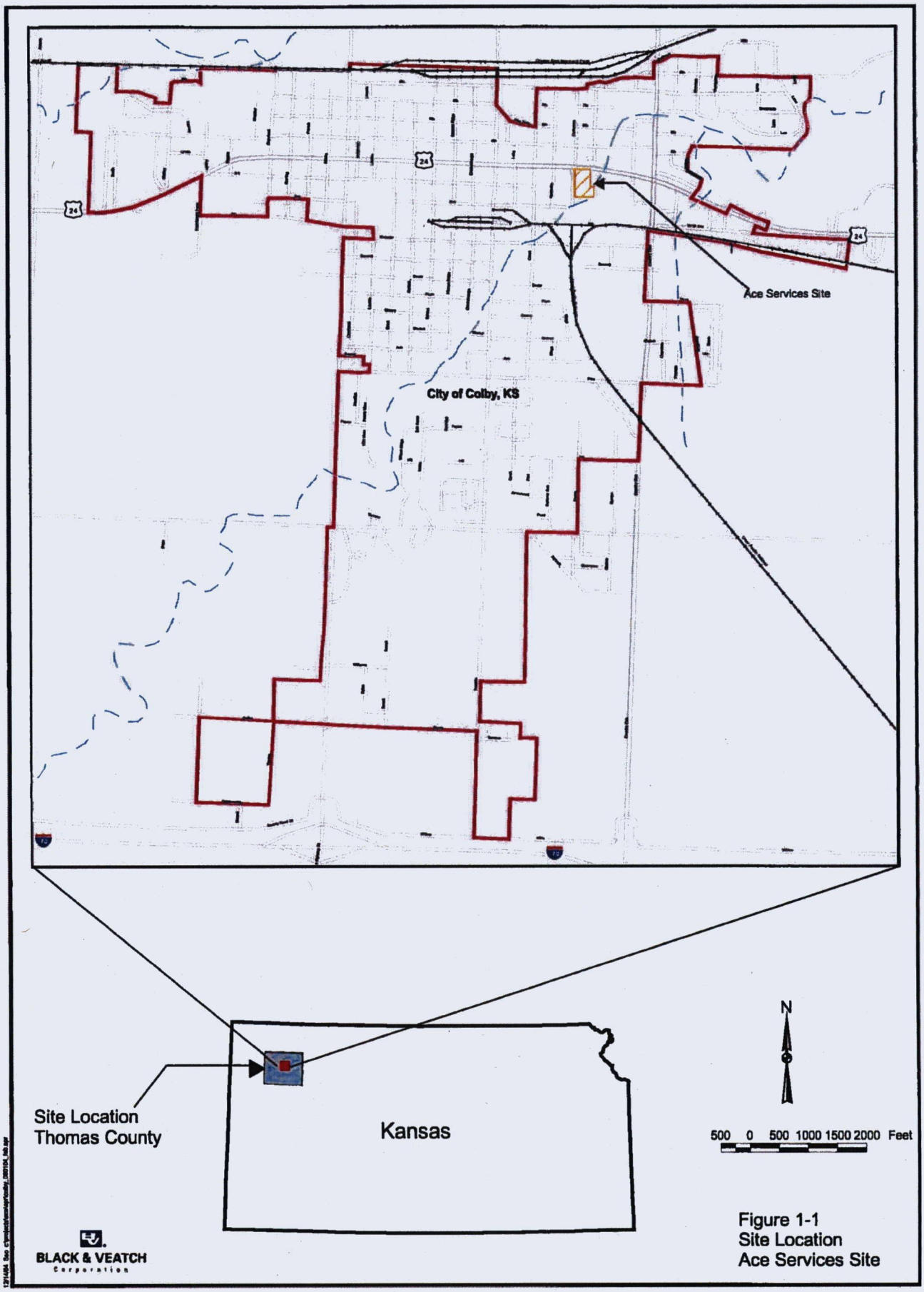
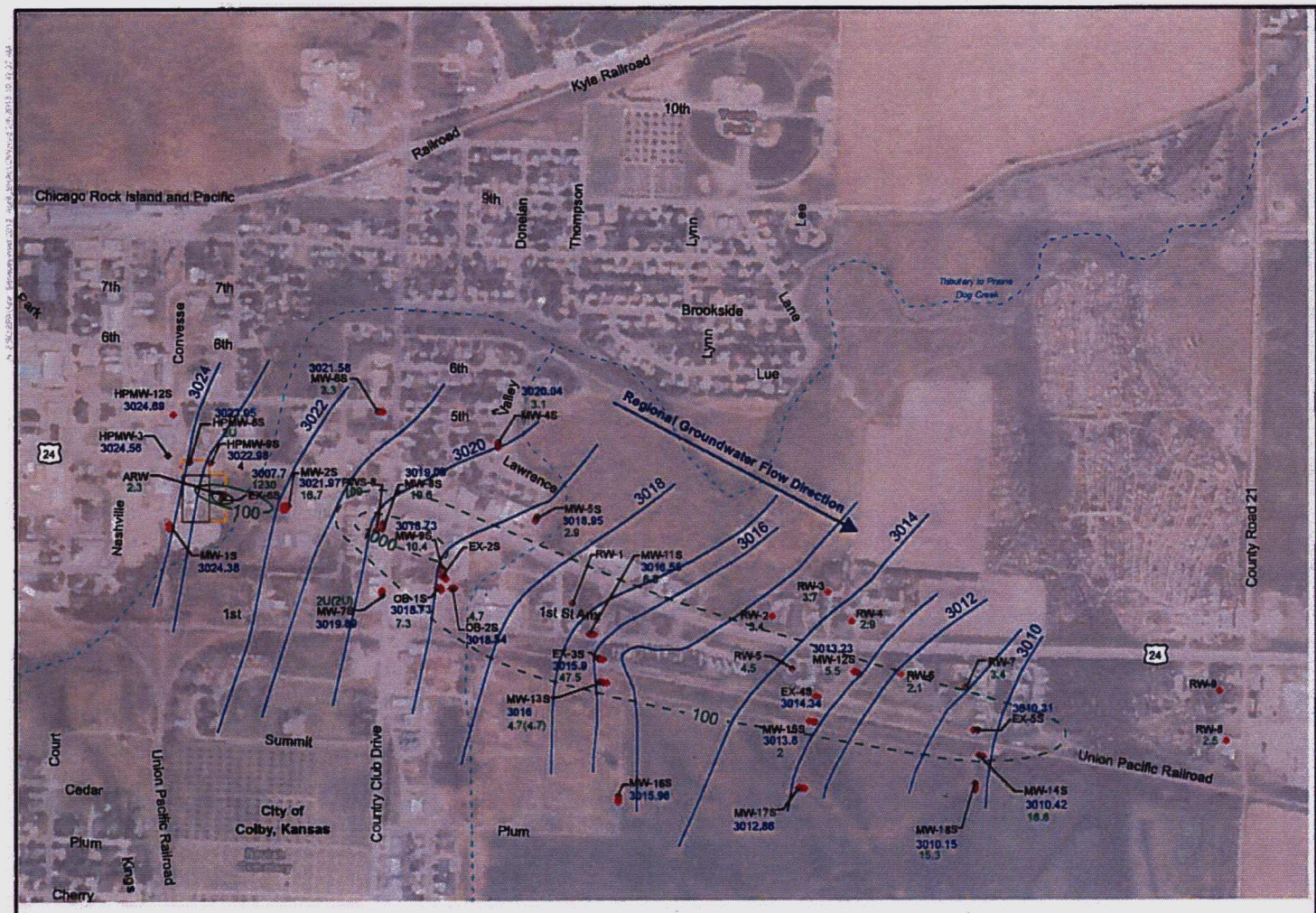


Figure 1-1
Site Location
Ace Services Site



Note:
Well construction data are not available for residential wells (RW). RW data are presented for reference only and are not contoured.

BLACK & VEATCH
Corporation

Ace Services Site
Colby, Kansas

N
W E
S

250 125 0 250 500 750 1,000 Feet

Legend

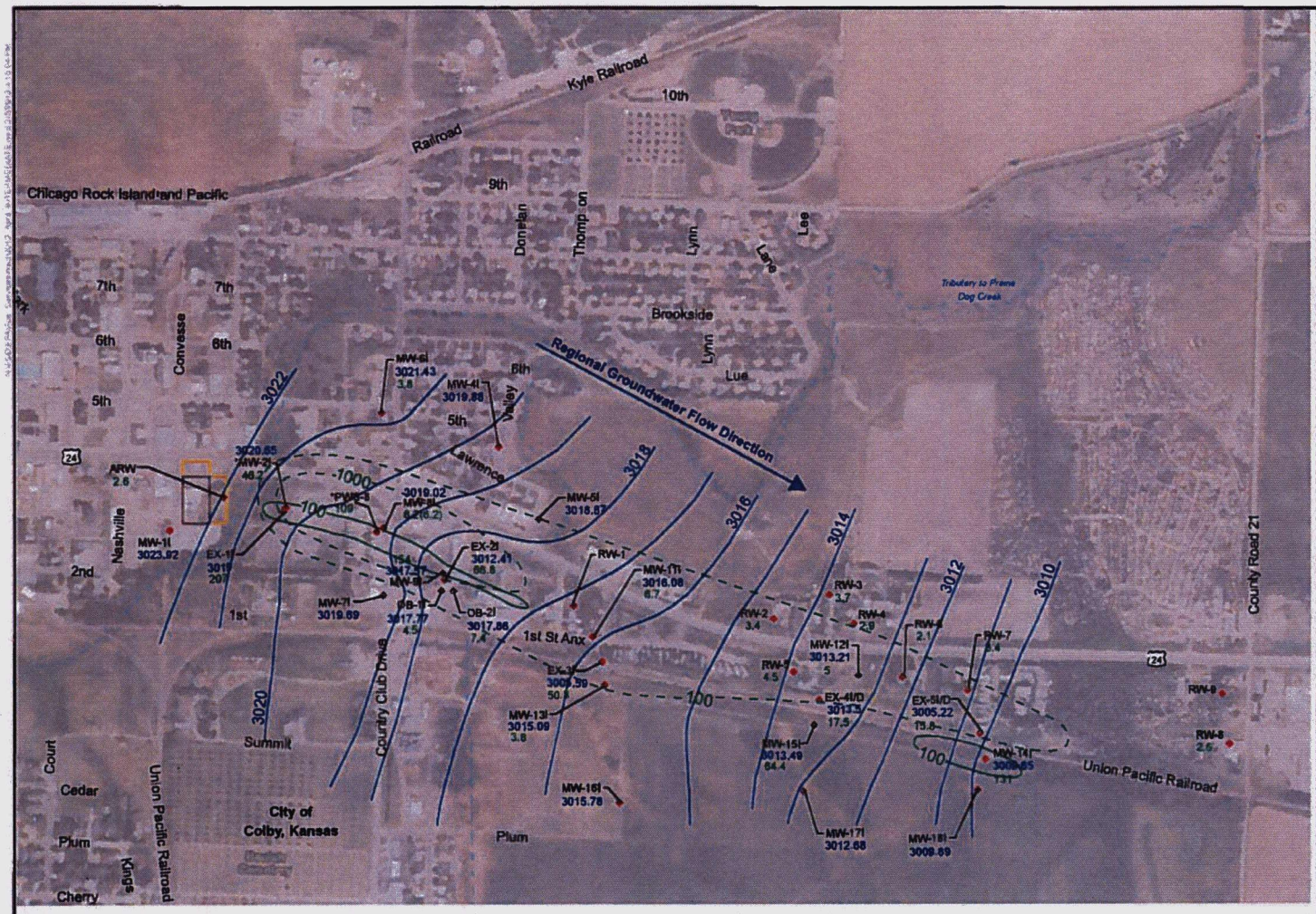
- MW-11S 3019.68 <15 — Well Location with April 2012 Chromium Concentration (Green) and Groundwater Elevation (Blue)
- Total Chromium Isoconcentration Contour (ug/L) (April 2012)
- Initial Total Chromium Isoconcentration Contour (ug/L) (April 2003)
- Groundwater Elevation (MSL)(April 9, 2012)
- Streams
- Railroads
- Roads
- Former Ace Services Site
- Groundwater Treatment Plant

Note * = Data point outlier not included in contours.

Abbreviations

MW = Monitoring Well
RW = Residential Well
OB = Observation Well
HPMW = Hi-Plains Co-op Monitoring Well
EX = Extraction Well
PWS = Public Water Supply
S = Shallow
I = Intermediate
D = Deep

Figure 2-1
Total Chromium Isoconcentration Contour Map and Groundwater Flow Direction - Shallow Zone Ace Services Site (April 2012)



Note:
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Corporation

Ace Services Site
Colby, Kansas

N
W E
S

250 125 0 250 500 750 1,000 Feet

Legend

- MW-11S — Well Location with April 2012 Chromium Concentration (Green) and Groundwater Elevation (Blue)
- 3022.21 415
- Total Chromium Isoconcentration Contour (ug/L) (April 2012)
- Initial Total Chromium Isoconcentration Contour (ug/L) (April 2003)
- Groundwater Elevation (MSL)(April 9, 2012)
- Streams
- Railroads
- Roads
- Former Ace Services Site
- Groundwater Treatment Plant

Note * = Data point outlier not included in contours.

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RW = Residential Well

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HPMW = Hi-Plains CO-OP Monitoring Well

EX = Extraction Well

PWS = Public Water Supply

S = Shallow

I = Intermediate

D = Deep

Figure 2-2
Total Chromium Isoconcentration Contour Map and Groundwater Flow Direction - Intermediate Zone
Ace Services Site (April 2012)

Note:
Well construction data are not available for residential wells (RW). RW data are presented for reference only and are not contoured.

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Corporation

Ace Services Site
Colby, Kansas

N
W E
S

250 125 0 250 500 750 1,000 Feet

Legend

- MW-11S 3022.21 <1.5 — Well Location with April 2012 Chromium Concentration (Green) and Groundwater Elevation (Blue)
- Total Chromium Isoconcentration Contour (ug/L) (April 2012)
- Initial Total Chromium Isoconcentration Contour (ug/L) (April 2003)
- Groundwater Elevation (MSL)(April 9, 2012)
- Streams
- Railroads
- Roads
- Former Ace Services Site
- Groundwater Treatment Plant

Note * = Data point outlier not included in contours.

Abbreviations

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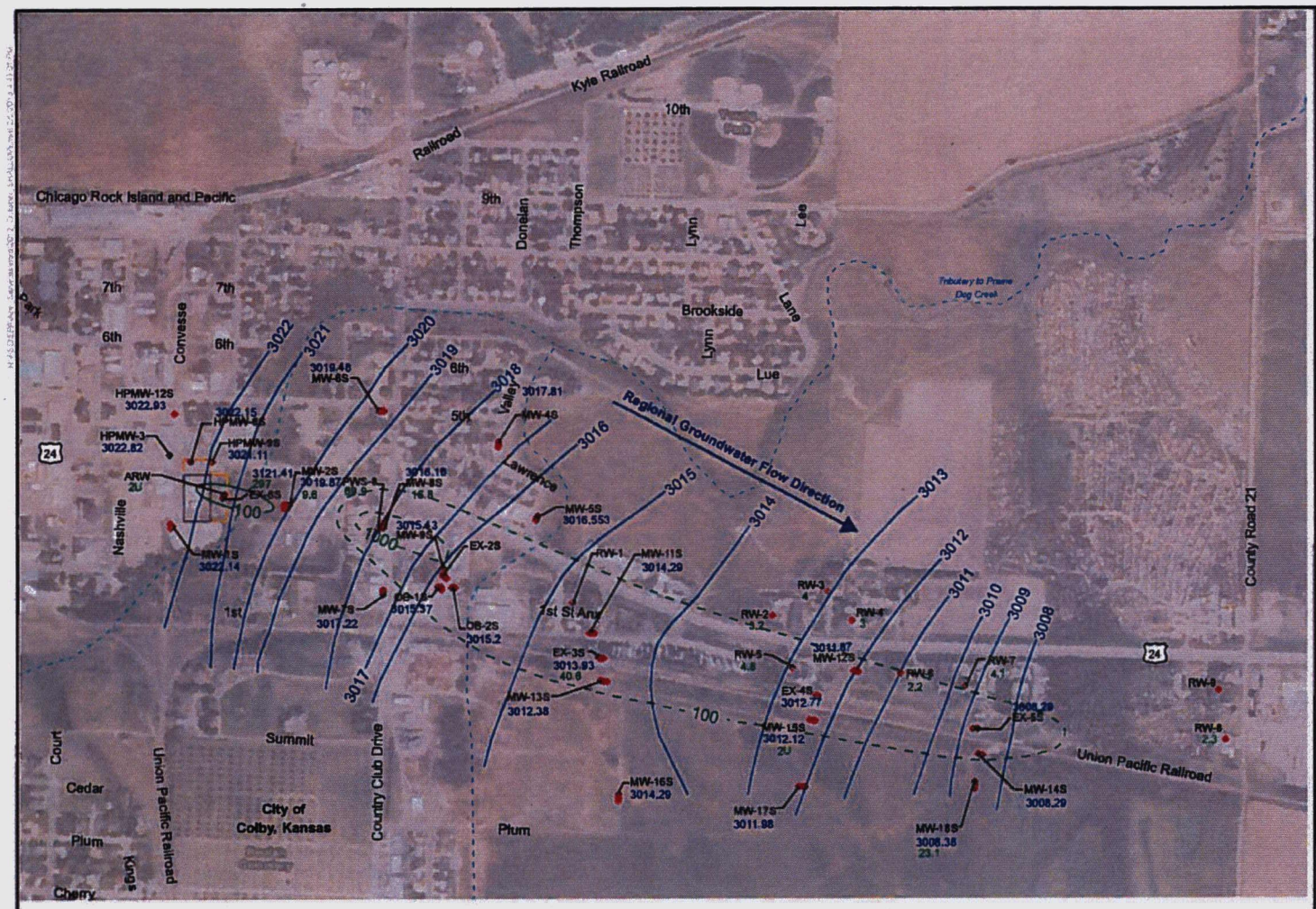
RW = Residential Well
OB = Observation Well
HPMW = Hi-Plains CO-OP Monitoring Well
EX = Extraction Well
PWS = Public Water Supply
S = Shallow
I = Intermediate
D = Deep

Figure 2-3
Total Chromiun Isoconcentration Contour Map and Groundwater Flow Direction - Deep Zone Ace Services Site (April 2012)



Note:
Well construction data are not available for residential wells (RW). RW data are presented for reference only and are not contoured.

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Corporation

Ace Services Site
Colby, Kansas

N
W E
S

250 125 0 250 500 750 1,000 Feet

Legend

- MW-11S 3019.68 <1.5 — Well Location with October 2012 Chromium Concentration (Green) and Groundwater Elevation (Blue)
- Total Chromium Isoconcentration Contour (ug/L) (October 2012)
- Initial Total Chromium Isoconcentration Contour (ug/L) (April 2003)
- Groundwater Elevation (MSL)(October 22, 2012)
- Streams
- Railroads
- Roads
- Former Ace Services Site
- Groundwater Treatment Plant

Note * = Data point outlier not included in contours.

Abbreviations

MW = Monitoring Well

RW = Residential Well

OB = Observation Well

HPMW = Hi-Plains Co-op Monitoring Well

EX = Extraction Well

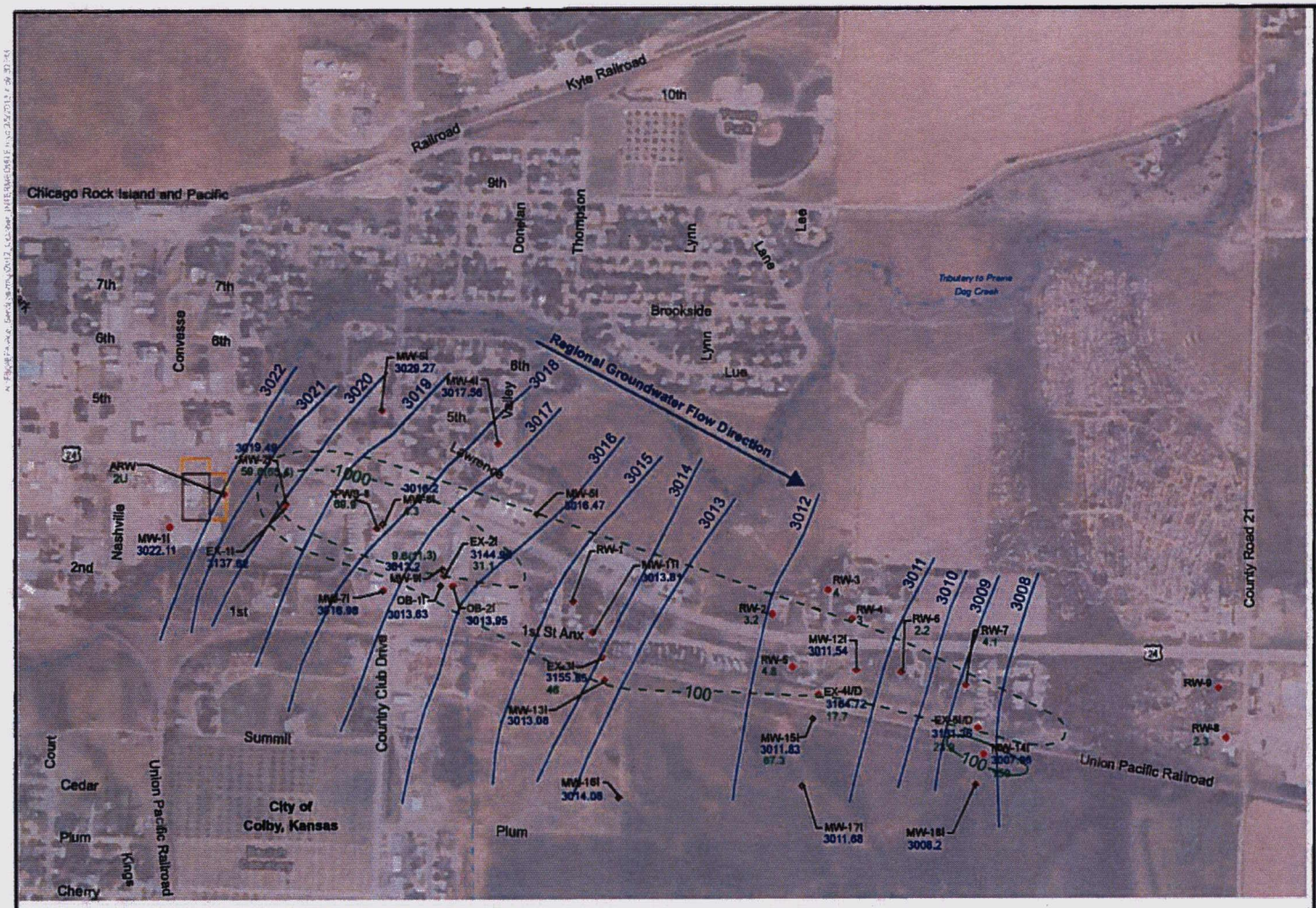
PWS = Public Water Supply

S = Shallow

I = Intermediate

D = Deep

Figure 2-4
Total Chromium Isoconcentration Contour Map and Groundwater Flow Direction - Shallow Zone Ace Services Site (October 2012)



Note:
Well construction data are not available for residential wells (RW). RW data are presented for reference only and are not contoured.

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Corporation

Ace Services Site
Colby, Kansas

N
W E
S

250 125 0 250 500 750 1,000 Feet

Legend

- MW-11S — Well Location with October 2012 Chromium Concentration (Green) and Groundwater Elevation (Blue)
- 3022.21 <15
- Total Chromium Isoconcentration Contour (ug/L) (October 2012)
- Initial Total Chromium Isoconcentration Contour (ug/L) (April 2003)
- Groundwater Elevation (MSL)(October 22, 2012)
- Streams
- Railroads
- Roads
- Former Ace Services Site
- Groundwater Treatment Plant

Note * = Data point outlier not included in contours.

Abbreviations

MW = Monitoring Well

RW = Residential Well

OB = Observation Well

HPMW = Hi-Plains CO-OP Monitoring Well

EX = Extraction Well

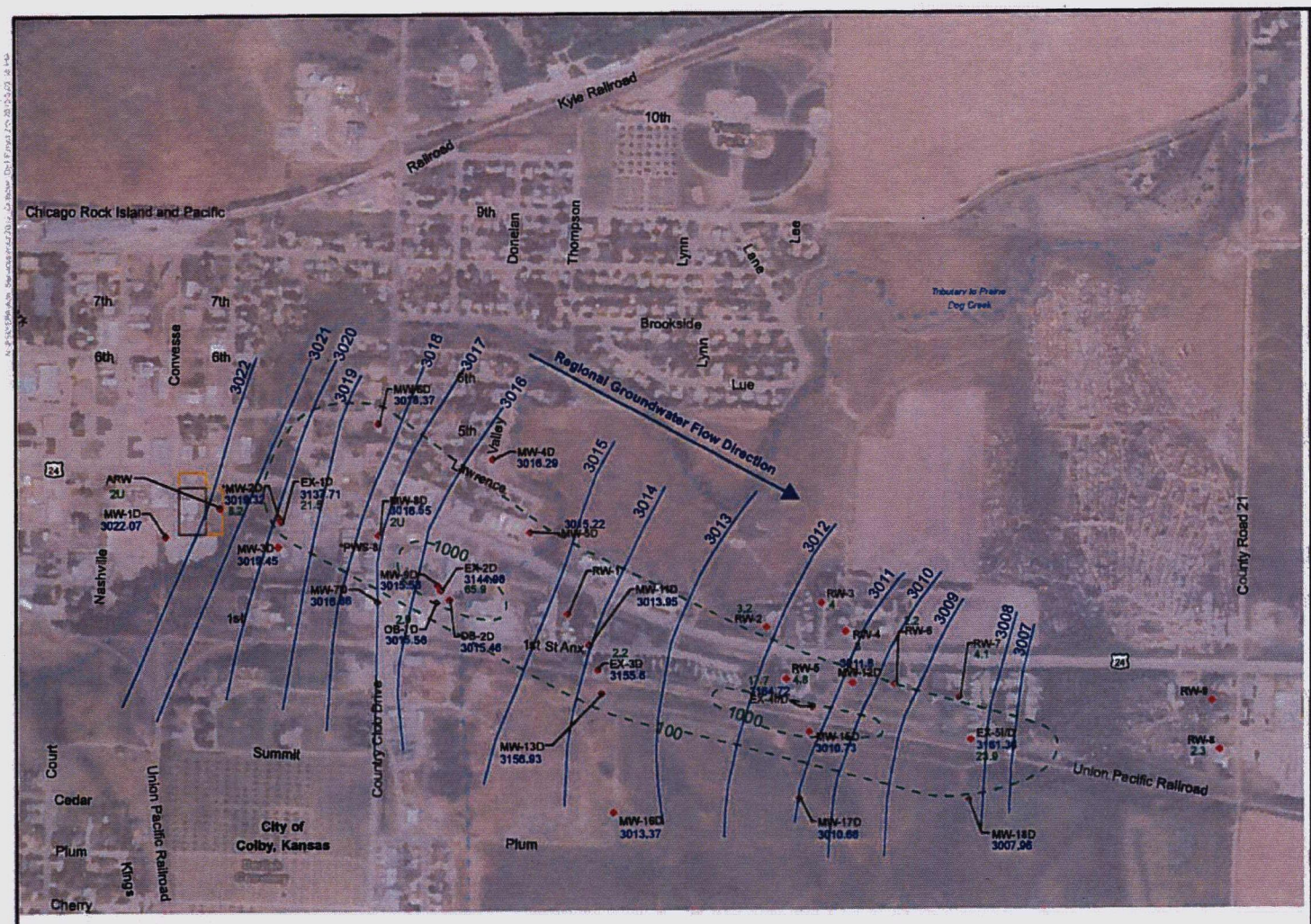
PWS = Public Water Supply

S = Shallow

I = Intermediate

D = Deep

Figure 2-5
Total Chromiun Isoconcentration Contour Map and Groundwater Flow Direction - Intermediate Zone
Ace Services Site (October 2012)



Ace Services Site
Colby, Kansas

N
W E
S

250 125 0 250 500 750 1,000 Feet

Legend

- MW-11S 3022.21 +15 — Well Location with October 2012 Chromium Concentration (Green) and Groundwater Elevation (Blue)
- Total Chromium Isoconcentration Contour (ug/L) (October 2012)
- Initial Total Chromium Isoconcentration Contour (ug/L) (April 2003)
- Groundwater Elevation (MSL)(October 22, 2012)
- Streams
- Railroads
- Roads
- Former Ace Services Site
- Groundwater Treatment Plant

Note * = Data point outlier not included in contours.

Abbreviations

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RW = Residential Well

OB = Observation Well

HPMW = Hi-Plains CO-OP Monitoring Well

EX = Extraction Well

PWS = Public Water Supply

S = Shallow

I = Intermediate

D = Deep

Note:
Well construction data are not available for residential wells (RW). RW data are presented for reference only and are not contoured.

BLACK & VEATCH
Corporation

Figure 2-6
Total Chromium Isoconcentration Contour Map and Groundwater Flow Direction - Deep Zone Ace Services Site (October 2012)

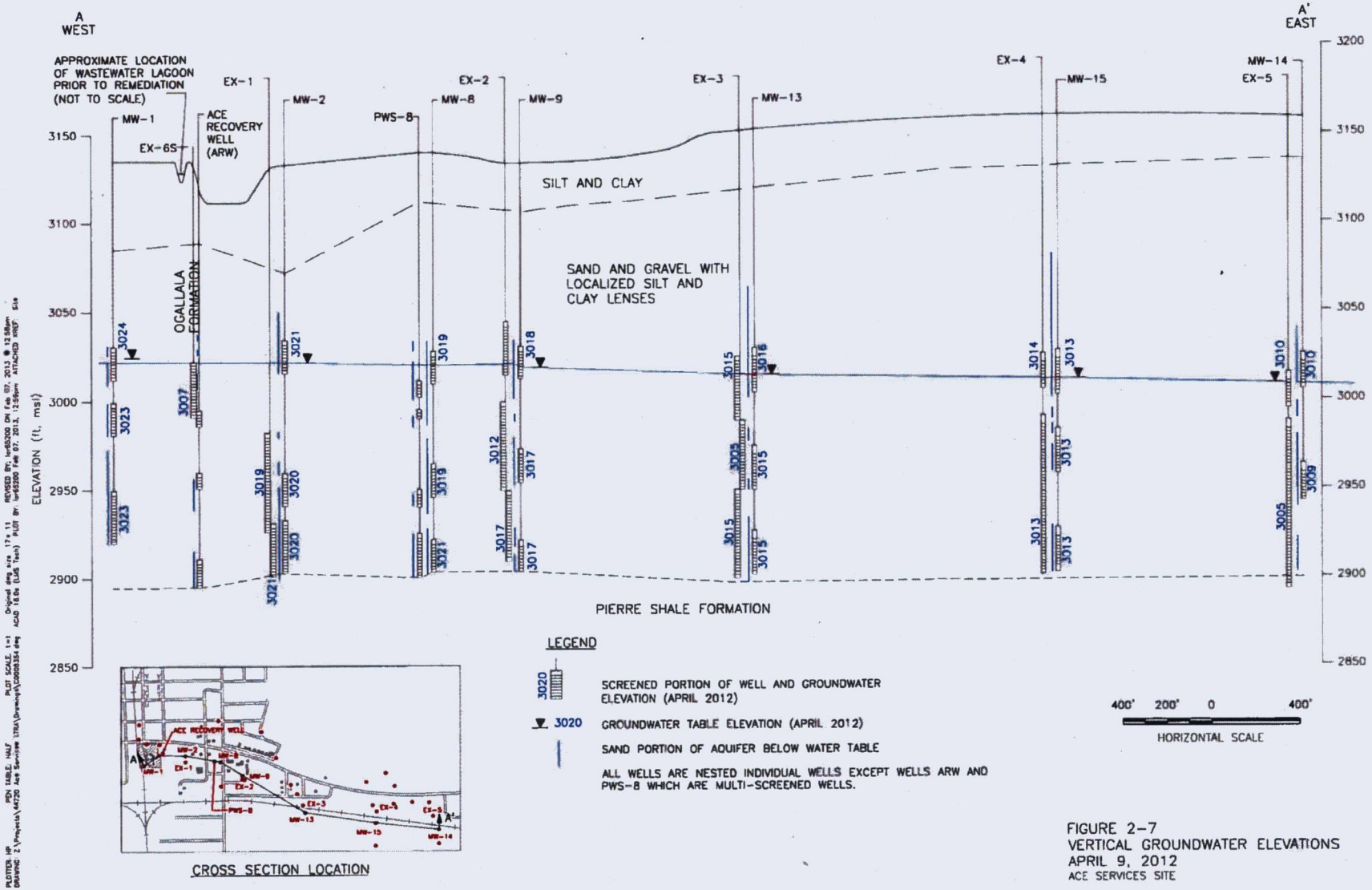

FIGURE 2-7
VERTICAL GROUNDWATER ELEVATIONS
APRIL 9, 2012
ACE SERVICES SITE

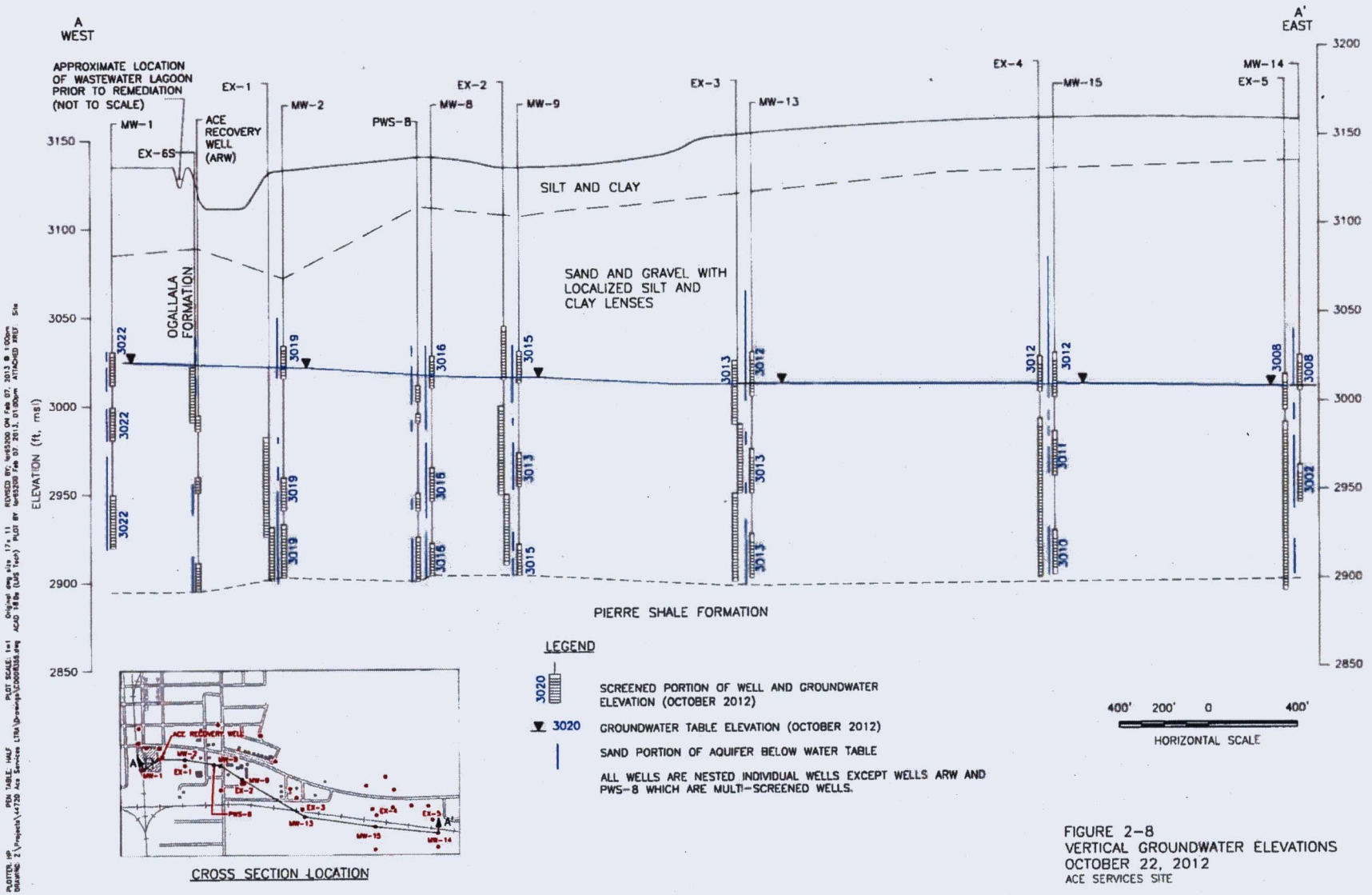

FIGURE 2-8
VERTICAL GROUNDWATER ELEVATIONS
OCTOBER 22, 2012
ACE SERVICES SITE

ATTACHMENT A

Monitoring Data Summary Table

Table 2-2
Semi-Annual Analytical
Results Summary
April 2003 through October 2012
Ace Services Site

Well Number	Total Cr																														
	April 2003	September 2003	October 2003	November 2003	December 2003	January 2004	February 2004	March 2004	April 2004	June 2004	August 2004	October 2004	December 2004	April 2005	October 2005	April 2006	October 2006	April 2007	October 2007	April 2008	September 2008	April 2009	October 2009	April 2010	October 2010	April 2011	October 2011	April 2012	October 2012
Shallow Wells																															
MW 1 S	1.1 U	-	15 U	-	-	-	-	-	15 U	-	-	15 UJ	-	15 U	10 U	15 U	10 U	15 U	-	-	-	10 U	-	-	-	4.2	-	-	-
MW 2 S	68.1	39	23	49.8	47.1	41.9	34.8	26.5	19.1	29	16.7	15 U	15 U	15 U	10 U	15 U	10 U	583	30	15 U	172	17.4	10 U	2.8	5.4	7.3	5.4	16.7	8.9
MW 4 S	3.8	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	2 U	-	2 (3.2)	-	3.1	-
MW 5 S	2.6	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	2 U	-	3.1	-	2.6	-
MW 6 S	1.9 (1.8)	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	11.7 J	-	2.9	-	4.6	-	3.3	-
MW 7 S	48.1	-	15 U	-	-	-	-	-	45	-	-	31.6	-	45.7	18.9	13.1	10 U	95 U	-	15 U	-	10 U	-	3.1	-	2.7	-	2.8 U (2.8 U)	-
MW 8 S	1830	13 U	15 U	15.2	17.6	16.6	17.7	15 U	15 U	26.2	21.6	23.1	15 U	15 U	37.6	43.3	51.2	15 U	15 U	15 U	10 U	10 U	10 U	4.5	7.8	14.9	6.5	19.6	16.8
MW 9 S	720	71.4	19	79.4	100	111	95.8	116	138	195	211	183	15 U	15 U	58	37.1	36.6	29	-	17	-	19.1 J	-	12.1	-	12.8	-	19.4	-
MW 11 S	182	-	68	-	-	-	-	-	19.1	-	-	26.5	-	15 U	14.2	15 U	4.2	15 U	-	15 U	-	10 U	-	5.7	-	6.4	-	6.6	-
MW 12 S	38.4 (38.1)	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10.5	15 U	10 U	15 U	-	15 U	-	10 U	-	2.9	-	2.9	-	5.5	-
MW 13 S	173	182	152	165	151	148	163	117	92.9 (97.9)	98.6	50.6	43.5	34	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	-	-	7.3	-	4.7 (4.7)	-
MW 14 S	133	57.8	51	70.5	57.1	52.1	49.8	42.7	23.5	46.5	27	22.5	15 U	15 U	18.6	28	22.3	16	-	28	-	38.7 (42.7)	-	-	-	7 (6.4)	-	16.6	-
MW 15 S	704	267	200	304	162	158	159	185	232	137	108	189	162	163	111	186	177	66 (67)	74	34	58.2	90 U	10 U	-	2 U	3 U	2 (2.6)	7.6 U	2 U
MW 16 S	1.7	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	-	-	10 U	-	-	-	3 U	-	-	-
MW 17 S	25.1	-	15 U	-	-	-	-	-	15 U (15 U)	-	-	15	-	15 U	11.4	15 U (15 U)	27.4	15 U	-	-	-	10 U	-	-	-	3.5	-	-	-
MW 19 S	84.6	-	42	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U (15 U)	23.1	27 (15U)	25	25	22.5	18.3	19.2	24.0	20.7	18.8	15.5	15.3	23.1
APW - S	171	-	252	-	-	-	-	-	1640	-	2370	2610	2560(2570)	3610	1800	1750	982	15 U	23	81	184	217 (218)	135	7 U	7 U	18	4.3 U	7.3	7 U
OB 1 S	278	-	15 U	-	-	-	-	-	23.8	-	-	50.1	-	15 U	10 U	15.8	77.4	15 U	-	15 U	-	10 U	-	4.4	-	2.8	-	7.3	-
OB 2 S	388	-	61	-	-	-	-	-	45.8	-	-	56.5	-	15 UJ	20.3	38.2	26.7	16	-	15 U	-	12.9 J	-	9.2	-	5.9	-	4.7	-
DHPMW 3 S	-	-	15 U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15 U	-	-	-	-	-	-	-	-	-	-	-
DHPMW 8 S	1.4	-	-	-	-	-	-	-	-	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	2 U	-	2.7	-	2.8 U	-
DHPMW 9 S	0.91	-	-	-	-	-	-	-	780	-	-	-	-	-	17.2	64	10 U (10 U)	15 U	-	15 U	-	84.3	-	3.4	-	14.8	-	4.0	-
EX 7 S	-	-	61	485	609	379	321	279	203	238	299	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EX 3 S	-	210	184	480	479	305	160 (180)	150	113	141	109	83.4	70.9	15 U	33.6	17.7	12.2	33	15 U	31	29.2	43.2	17.6	-	30.5	50.4	2 U	47.5	40.8
EX 4 S	-	127	81	77.7	70.2	68.5	62.8	-	15 U	54.5	58.6	15 U	35.1	15 U	17.5	15 U	10 U	15 U	5U	15 U	18 U	10 U	18 U	-	-	-	-	-	-
EX 5 S	-	77.2	62	56.9	54.1	54.2	50.8	44.2	29.4	42.7	32	25.9	16.4	15 U	21.5	15 U	10 U	15 U	1.25	15 U	34.1	16.7	10 U	-	-	-	-	-	-
EX 6 S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	210	1380	1840	1130	676	484	643	1210	297

Table 2-2
Semi-Annual Analytical
Results Summary
April 2003 through October 2012
Ace Services Site

Well Number	Total Cr																													
	April 2003	September 2003	October 2003	November 2003	December 2003	January 2004	February 2004	March 2004	April 2004	June 2004	August 2004	October 2004	December 2004	April 2005	October 2005	April 2006	October 2006	April 2007	October 2007	April 2008	September 2008	April 2009	October 2009	April 2010	October 2010	April 2011	October 2011	April 2012	October 2012
Intermediate Wells																														
MW 1 I	0.7 U	-	15 U	-	-	-	-	-	10 U	-	-	15 U	-	15 U (15 U)	10 U	15 U	10 U	15 U	-	-	-	-	10 U	-	-	-	2 U	-	-	-
MW 2 I	848 (1000)	830	806 (85.1)	984	1,700	872	1340	1280	1540	1230	1143	1160	1570	586 (616)	406	253	143	124	117 (117)	98	88.7 (87)	79.4	47.5 (46.5)	29.2 (27.7)	18.5	4.3	18.7	44.7	58 (583.4)	
MW 4 I	24.7	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	-	-	10 U	-	-	-	1.8	-	-	-	
MW 5 I	19.8 (18.8)	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	-	-	10 U	-	-	-	6.5	11.9	-	-	
MW 6 I	14.9	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	3.9	-	5.8	-	3.8	-	
MW 7 I	13.2	-	15 U	-	-	-	-	-	15 U	-	-	29.2	-	15 U	10 U	15 U	10 U	15 U	-	-	-	10 U	-	-	-	6.7	-	-	-	
MW 8 I	1960	80.4	58	20.9	25	38.5	68.3	90.8	85.2 (87)	134	294	52.5	15 U	15 U	10.7 (10.4)	15 U	10 U	15 U	15 U	15 U	10 U	10 U	10 U	5.3	18.9	16.6	8.2 (8.7)	4.3	
MW 9 I	7820	646	416	471	775	868	2180	2000	1840	1570	2810 (2750)	258	148	15.7	17	15 U	10 U	15 U	-	15 U	-	10 U	-	4.4	-	21.4	-	154	9.8 (11.3)	
MW 11 I	367	-	103 (105)	-	-	-	-	-	19.1	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	4.8	-	8.0	-	8.7	-	
MW 12 I	132	-	113	-	-	-	-	-	18.3	-	-	15 U	-	15 U	10 U	15 U (15 U)	10 U	15 U	-	15 U	-	10 U	-	4.8	-	5.5	-	9.0	-	
MW 13 I	78.3	4.36	1.89	68.9	77.6	111	104	74	54.6	52.3	35.2	35.6 (34.6)	15 U	15 U	10	15 U	10 U	15 U	-	15 U	-	10 U	-	-	-	3.7	-	3.8	-	
MW 14 I	197	80.7	143	150	135	108	97.8	73	44.9	39.7	36.9	30.3	18.2	15 U	11	16.3	37.1	60	-	19 U (13 U)	-	15.6	-	-	-	96.1	-	131	150	
MW 15 I	58.4	96.5	171	179	338	318	328	158	121	87.2	24.2	20.5	15 U	15 U	10 U	15 U	10 U	15 U	-	15 U	-	57.7	-	-	-	61	-	84.4	87.3	
MW 16 I	3.8	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	-	-	10 U	-	-	-	2 U	-	-	-	
MW 17 I	3.9	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	-	-	12.1	-	-	-	18.4	-	-	-	
MW 18 I	17.9	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U (10 U)	15 U	-	-	-	10 U	-	-	-	22.3	-	-	-	
MPW 1 I	4.9	-	7.65	-	-	-	-	-	11.9	-	9.57	17.9	7.58	18.9	7.94	8.84	9.5	15 U	-	7.9	10.5	9.83	10.9	2 U	2 U	10.2	2 U	2.8	2 U	
OB 1 I	1.95	-	88	-	-	-	-	-	77.2	-	-	79.8	-	15 U	10 U	15 U	26.3	19	-	15 U	-	11.8 J	-	6.5	-	8.7	-	4.5	-	
OB 2 I	408	-	15 U	-	-	-	-	-	111	-	-	207	-	170	132	111	77	46	-	19	-	14.6 J	-	15.1	-	4.8	-	7.4	-	
EX 1 I	-	1410	1390	1380	1810	1070	1150	1140	1040	3270	1780	1300	1150	953	829	887 (880)	509	379	345	315 (310)	347	241 (257)	257 (264)	287 (284)	289 (294)	240	236	207		
EX 2 I	-	779	527 (548)	1700	1560	1810	1520	1220	997	1750	1420	743	346	205	181	114	80	53 (51)	43	29	158 (161)	28.6	100	19.3	27.1 (32.2)	147	116	66.8	33.1	
EX 3 I	-	-	-	884	708	431	382	368	331	618	315	296	272	149 (148)	1.95	180	72	59	39 (38)	43 (42)	354	48.1 (39.6)	290	-	35.5	230	84.5	30.3	48	
EX 4 I/C	-	178	156	154	166	173	181	151	145	130	110	108	85.8	63.1	61	46.1	36.5	30	15 U	19	17.3	18.7	15.8	-	45.5	19	24.1 (24.3)	17.5	17.7	
EX 5 I/C	-	129	136	178	129	137	127	118	83.2	107	83.2	88.2	72.5	27.8	51	64.8	67.5	105	15 U	31	27.8	21.6	18 U	-	2 U	2.3	11.9	15.8	23.9	
PW8 6	-	1040 (1070)	940	1900	2000	2150	2110	2040	2280	2110	3160	1180	797	443	350 (344)	324	150	119	15 U	91	101	74.8	-	65.1	69.7	94.7	202	109	83.9	

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Results Summary
April 2003 through October 2012
Ace Services Site

Well Number	Total Cr																														
	April 2003	September 2003	October 2003	November 2003	December 2003	January 2004	February 2004	March 2004	April 2004	June 2004	August 2004	October 2004	December 2004	April 2005	October 2005	April 2006	October 2006	April 2007	October 2007	April 2008	September 2008	April 2009	October 2009	April 2010	October 2010	April 2011	October 2011	April 2012	October 2012
Deep Wells																															
MW 1 D	5.6	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	3 U	-	2.2	-	-	-	-
MW 2 D	184	75.4	38	29.6	107	72.9	145	125	168	212	630 (903)	65.4	158	55.2	10U (18U)	38.3	10 U	15 U (15 U)	15 U	15 U	18 U	11.5 (11.5)	30.7	38.2	5.8	25	16.3	3.3	8.7	-
MW 3 D	8.7	-	15 U	-	-	-	-	-	375	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	3 U	-	2.2	-	7.0 U	-	-
MW 4 D	1.6	-	15.9 (16.4)	-	-	-	-	-	15 U	-	-	46.4	-	15 U	10 U	15 (15) U	10	15 U	-	15 U	-	10 U	-	3 U	-	2.2	-	2.1	-	-
MW 5 D	1.6	-	15 U	-	-	-	-	-	10 U	-	-	15 U	-	15 U	21.1	15 U	10 U (10 U)	15 U	-	-	-	10 U	-	-	-	2.6	-	-	-	-
MW 6 D	108	-	71	-	-	-	-	-	33.7	-	-	20.8	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	3 U	-	2 U	-	2.5	-	-
MW 7 D	26.1	-	15 U	-	-	-	-	-	33.8	-	-	35.4	-	15 U	10 U	15 U	10 U (10 U)	15 U	-	15 U	-	10 U	-	2 U	-	4.6	-	2.1	-	-
MW 8 D	478	15 U	15 U	15	74.1 (80.8)	130	168	137	814	148	319	15 U	15 U	15 U	10 U	15 U	10 U	15 U	15 U	15 U	10 U	10 U	18 U	7 U	2 U	2 U	2.4 U	7.0 U	2 U	-
MW 9 D	3340	464 (479)	15 U	1350	1800	1820 (1820)	1620	1800	1820 (1400)	1580 (1740)	1730	121	1470	15 U	10.1	15 U	10 U	15 U	-	27	-	30.1	-	20.9	-	60.9	-	36.3	-	-
MW 11 D	982	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	20.1	13.8	15 U (15 U)	-	15 U	-	11.4	-	8.2	-	7.3	-	5.7	-	-
MW 12 D	2.7 (3.0)	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	-	-	10 U	-	-	-	4.5(4.7)	-	65.1	-	-
MW 13 D	221	108	79	44	15 U	15 U	15 U	15 U (15 U)	15 U	15 U	18 U	15 U	15 U	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	-	-	2.6	-	2.9	-	-
MW 15 D	1240 (1200)	1330	980	868	467	364	380	305	273	202 (211)	125	134	120	41.7	37.2	22.9	11.1	15 U	-	15 U	-	10.1	-	-	-	31.8	-	20.6	-	-
MW 16 D	3	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10U (10U)	15	10 U	15 U	-	-	-	10 U	-	-	-	2 U	-	-	-	-
MW 17 D	72.1	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	-	-	10 U	-	-	-	2.1(2.8U)	-	-	-	-
MW 18 D	132	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	10 U	15 U	10 U	15 U	-	15 U	-	10 U	-	7 U	-	4.3	-	36.4 J (40.4)	-	-
MW - D	8.4	-	88	-	-	-	-	-	184	-	160	166 (186)	302	291	277	267	158	15 U	-	78	213	141	211	7.7 (2.1)	2 U	4.1	2 U	2 U	* 2.0 U	2 U
DB 1 D	1790	-	99	-	-	-	-	-	513	-	-	60.8	-	15 U	10 U	15 U	10 U	15 U	-	15 U (15 U)	-	10 U	-	-	-	8	-	8.6	-	2.9
DB 2 D	3770	-	720	-	-	-	-	-	604	-	-	247	-	51.9	11.6	15 U	10 U	15 U	-	15 U	-	10 U	-	5.6	-	20.3	-	20.4	-	-
EX 1 D	-	58.4	14	28.1	22	35.9	54.8	56.9	55.7	312	617	53.7	51.3	15U (15U)	17.4	15 U	10 U	15 U	15 U	15 U	10 U	10 U	10 U	7.2	2.1 J	2 U	10.9	4.2	21.5	
EX 2 D	-	654	465	634	686	640	636	680	685	580	1010	331	416	115	53.6	34.7	21.8	15 U	15 U	26	-	31.1	23	24.3	17.5	26.6	26.6	38.0	65.9	
EX 3 D	-	478	409	371	349	324	268	282	177	186	108	78	59.7	15.4	38.9	31.9	12.3	15 U	31	15 U	-	38.6	70.2	-	25.6	62.6	26.7 J	23.0	7.2	

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Ace Services Site

Well Number	Total Cr																															
	April 2003	September 2003	October 2003	November 2003	December 2003	January 2004	February 2004	March 2004	April 2004	June 2004	August 2004	October 2004	December 2004	April 2005	October 2005	April 2006	October 2006	April 2007	October 2007	April 2008	September 2008	April 2009	October 2009	April 2010	October 2010	April 2011	October 2011	April 2012	October 2012
Residential Wells																																
RW 1	27.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10 U	15 U	15 U	15 U	10 U	10 U	10 U	3.3 U	3.7	4.3	3.9 U	3.4	3.2
RW 2	1.9	-	15 U	-	-	-	-	-	15 U	-	-	61	-	22.1	11.2	15 U	10 U	15 U	15 U	15 U	10 U	10 U	10 U	3.3 U	3.7	4.3	3.9 U	3.4	3.2
RW 3	3.2	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	18 U	15 U (15 U)	10 U	15 U	15 U	15 U	10 U	10 U	10 U	3.7	7.2	3.9	4 U	3.7	4
RW 4	3.8	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	18 U	15 U (15 U)	10 U	15 U	15 U	15 U	10 U	10 U	10 U	7.8	3	2 (3.2) (3.2)	3 U	2.9	3
RW 5	8.2	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	38.2	27.8 (27.4)	10 U	15 U	15 U	15 U	10 U	10 U	10 U	5.1	5.3	5.8	4.8 U	4.5	4.6
RW 6	94.1	-	56	-	-	-	-	-	15 U	-	-	15 U	-	15 U	19 U	15 U	10 U	15 U	15 U	15 U	10 U	10 U	10 U	2 U	3.4	7.5	3 U	2.1	2.2
RW 7	47.5	-	17	-	-	-	-	-	15 U	-	-	15 U	-	15 U	19 U	15 U	10 U	15 U	15 U	15 U	10 U	10 U	10 U	2.3 U	2.8	3.7	4 U	3.4	4.1
RW 8	78.7	-	61	-	-	-	-	-	74.3	-	-	90.1	-	19 U	79.9	17.2	13.1	15 U	15 U	19 U	10 U	18.2 J	10 U	5.0	6.2	6.1	4.6 U	3.5	7.5
RW 9	2.4	-	15 U	-	-	-	-	-	15 U	-	-	15 U	-	15 U	18 U	15 U	10 U	15 U	15 U	15 U	10 U	10 U	-	-	-	-	-	-	-	-

Duplicate results in parentheses
Cr = chromium
ug/L = micrograms per liter
U = qualified as nondetect

S = shallow
I = intermediate
D = deep
- = no sample collected
1 = sample collected October 2006

MW = monitoring well
HFMW = Hi-Plains Co-op monitoring well
OB = Observation Well
ARVW = Ace Recovery well
PWS = public water supply
RW = residential well
EX = extraction well
SC = sample connection

ATTACHMENT B

Site Inspection Checklist

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Ace Services	**Date of inspection:** 10-30-12
Location and Region: Colby, Kansas, Region 7	**EPA ID:** KSD046746731
Agency, office, or company leading the five-year review: EPA Region 7	**Weather/temperature:**

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ■ Access controls
- ■ Institutional controls
- ■ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other _____
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _Jim Helus_____ Remediation Project Manager _____
   Name Title Date
   Interviewed ☐ at site ■ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency __Kansas Department of Health and Environment_____
Contact __Ashley Allen_____ _Project Manager _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ■ O&M manual — ■ Readily available — ■ Up to date — ☐ N/A
   - ■ As-built drawings — ■ Readily available — ■ Up to date — ☐ N/A
   - ■ Maintenance logs — ■ Readily available — ■ Up to date — ☐ N/A

   Remarks _____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ■ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ■ Effluent discharge — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Other permits _____ — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks No discharge permit is required. Effluent discharges to surface water or public water supply _____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

7. **Groundwater Monitoring Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks _____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☐ N/A

    Remarks _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other___City of Colby operates plant. Black & Veatch provides technical support._____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: __No_____

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency TOTAL, Pester, KDHE _____
Contact _____ _____
Name Title

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached
City ordinance prohibits installation of new wells.

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident
Remarks

2. **Land use changes on site** ☐ N/A
Remarks No

3. **Land use changes off site** ☐ N/A
Remarks No

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent_____
   ☐ Ponding ☐ Location shown on site map Areal extent_____
   ☐ Seeps ☐ Location shown on site map Areal extent_____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_____
   Remarks_____
   _____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

C. Treatment System ■ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   - ■ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☐ Air stripping ☐ Carbon adsorbers
   - ■ Filters _____
   - ☐ Additive (*e.g.*, chelation agent, flocculent) _____
   - ☐ Others _____
   - ■ Good condition ☐ Needs Maintenance
   - ■ Sampling ports properly marked and functional
   - ■ Sampling/maintenance log displayed and up to date
   - ■ Equipment properly identified
   - ☐ Quantity of groundwater treated annually _____
   - ☐ Quantity of surface water treated annually _____
   - Remarks _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   - ☐ N/A ■ Good condition ☐ Needs Maintenance
   - Remarks _____

3. **Tanks, Vaults, Storage Vessels**
   - ☐ N/A ■ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   - Remarks _____

4. **Discharge Structure and Appurtenances**
   - ☐ N/A ■ Good condition ☐ Needs Maintenance
   - Remarks _____

5. **Treatment Building(s)**
   - ☐ N/A ■ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☐ Chemicals and equipment properly stored
   - Remarks _____

6. **Monitoring Wells** (pump and treatment remedy)
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ■ Good condition
   - ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   - Remarks _____

D. Monitoring Data

1. Monitoring Data
   - ■ Is routinely submitted on time ■ Is of acceptable quality

2. Monitoring data suggests:
   - ■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

____The remedy is extraction and ion-exchange treatment of groundwater. The remedy is effective and functioning as designed._____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

____The O&M will be implemented by the state KDHE. The remedy is currently and in the long-term protective of human health and the environment._____

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

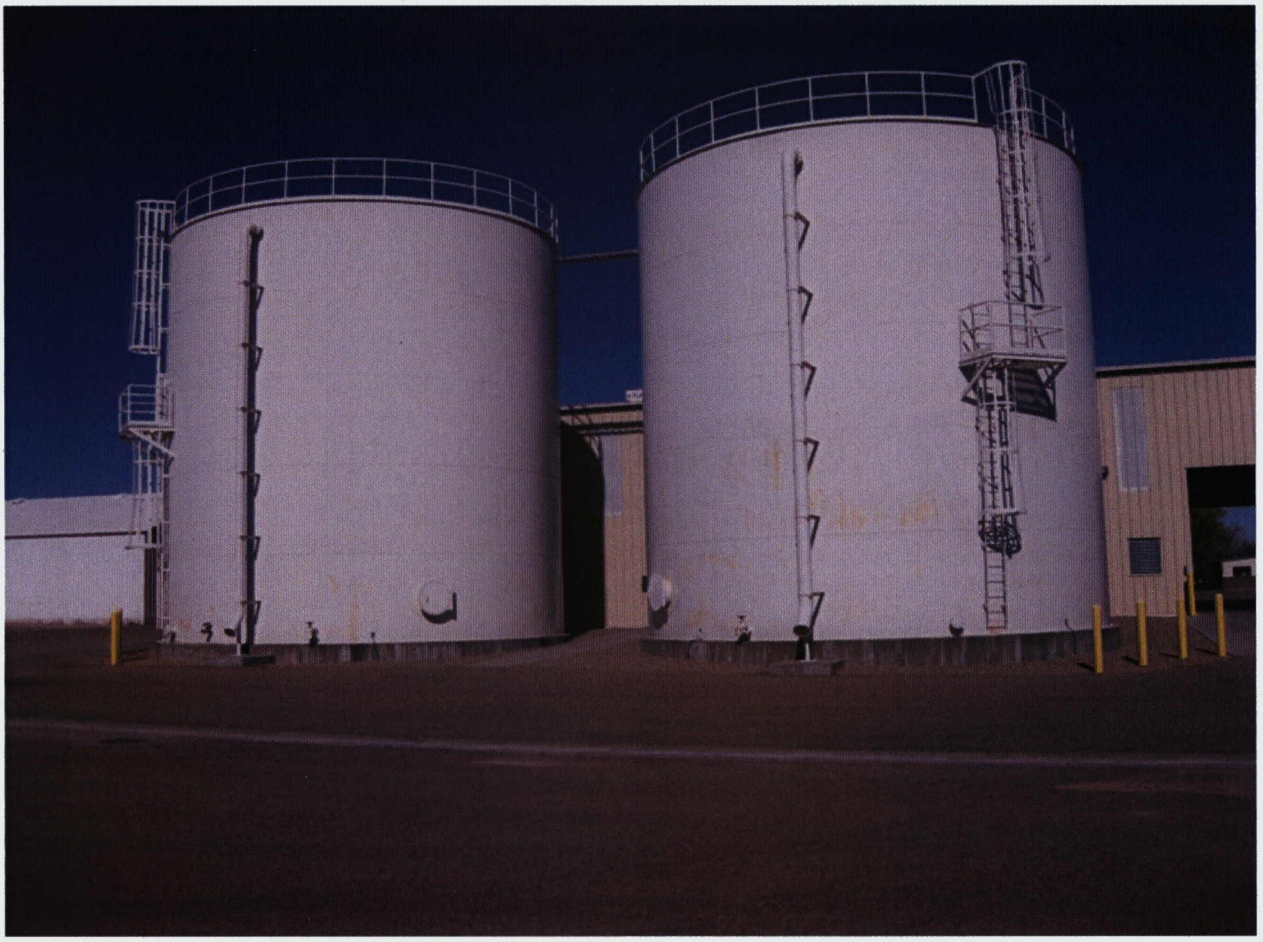
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

ATTACHMENT C

Site Photographs

Ace Services – Groundwater Treatment Plant, tanks and cap area, looking west

Ace Services – Influent and Effluent Tanks



Ace Services – Resin transfer vessel

Ace Services – Train B south side looking east